FLUKE

1020 Series

TOUCH CONTROL SCREEN

Manual Set

FLUKE

HOW TO USE THE 1020 SERIES MANUAL SET

1020 Series Manual Set (Option 1021-90)

The 1020 Series Manual Set provides comprehensive documentation for the Fluke 1020 Series Touch Control Screen (TCS). The set provides information for the system designer, software designer, the inspector, the installer, and the end user. The set includes the following manuals in a three-ring binder:

- Inspection and Installation Guide
- User's Guide
- Programmer's Guide
- Designer's Guide

A comprehensive Service Manual (P/N 868567) is also available. For 1020s with serial number below 4845000, order P/N 778803. For 1020s with serial number 4845000 or above, order P/N 868567.

1020 Series Inspection and Installation Guide (P/N 778779)

The Inspection and Installation Guide explains how to receive, inspect, store, install, and set up the TCS. The manual also includes a brief tutorial introduction to programming the TCS. This manual is shipped with each unit.

1020 Series User's Guide (P/N 778753)

The User's Guide provides basic operating instructions for the TCS. This manual is intended for the user who needs to know how to change Setup parameters but who won't otherwise program the TCS. This manual is also an essential reference for the programmer. Topics include: controls and indicators • turning on the TCS • using the Setup Screen • aligning the display • the optional keyboard • interpreting the Test Screen • glossary. (Language options may apply.)

1020 Series Programmer's Guide (P/N 778746)

The Programmer's Guide explains how to control the TCS from a host computer. Topics include: interfacing with the host computer • programming overview • displaying characters • controlling the display • programming the touch panel • programming the optional keyboard • sample programs • glossary. The Programmer's Guide includes a Quick Reference Guide (P/N 778795) and reproducible worksheets for designing touchkeys.

1020 Series Designer's Guide (P/N 778761)

The Designer's Guide helps the design engineer integrate the TCS into a custom system. This manual is intended for hardware, software, and packaging engineers. Topics include: overview of the TCS • specifications • electrical design considerations • mechanical design considerations • keyboard interface • how to design custom character sets • glossary.

1020 Series

TOUCH CONTROL SCREEN

Inspection and Installation Guide

FLUKE

LIMITED WARRANTY

Fluke warrants the 1030 Series Touch Control Screen to be free from defects in material and workmanship under normal use and service for 1 year from the date of shipment. Software and firmware products are provided "AS IS". We do not warrant that the software or firmware will be error free, operate without interruption or that all errors will be corrected. This warranty extends to you if you are the original purchaser and does not apply to fuses, batteries or any product which, in our sole opinion, has been subject to misuse, alteration or abnormal conditions of operation or handling.

To obtain warranty service, contact a Fluke Service Center or send the product, with a description of the difficulty, postage and insurance prepaid, to the nearest Fluke Service Center. We assume no risk for damage in transit.

We will, at our option, repair or replace the defective product free of charge or refund your purchase price. However, if we determine that the failure was caused by misuse, alteration, or abnormal condition of operation or handling, you will be billed for the repair. The repaired product will be returned to you, transportation prepaid.

THIS WARRANTY IS EXCLUSIVE AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTIBILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE. FLUKE WILL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES OR LOSS WHETHER IN CONTRACT, TORT, OR OTHERWISE.

CLAIMS

Immediately upon arrival, purchaser shall check the packing container against the enclosed packing list and shall, within thirty (30) days of arrival, give Fluke notice of shortages or any nonconformity with the terms of the order. If purchaser fails to give notice, the delivery shall be deemed to conform with the terms of the order.

The purchaser assumes all risk of loss or damage to instruments upon delivery by Fluke to the carrier. If an instrument is damaged in transit, PURCHASER MUST FILE ALL CLAIMS FOR DAMAGE WITH THE CARRIER to obtain compensation. Upon request by purchaser, Fluke will submit an estimate of the cost to repair shipment damage.

Fluke will be happy to answer all questions to enhance the use of this instrument. Please address your requests or correspondence to: JOHN FLUKE MFG. CO., INC., P.O. BOX C9090, EVERETT, WA 98206, ATTENTION: Sales Department. For European Customers: Fluke (Holland) B.V., P.O. Box 2269, 5600 CG Eindhoven, The Netherlands.

WARNING

THIS IS AN IEC SAFETY CLASS 1 PRODUCT. THE GROUND WIRE IN THE LINE CORD MUST BE CONNECTED FOR SAFETY.

Declaration of the Manufacturer or Importer

We hereby certify that the Fluke Model 1020, 1021 is in compliance with Postal Regulation Vfg. 1046 and is RFI suppressed. The marketing and sale of the equipment was reported to the German Postal Service. The right to retest this equipment to verify compliance with the regulation was given to the German Postal Service.

Bescheinigung des Hersteller/Importeurs

Hiermit wird bescheinigt, daß das Fluke Model 1020, 1021 in Übereinstimmung mit den Bestimmungen der Amtsblattverfugung Vfg. 1046 funk-entstört ist. Der Deutschen Bundespost wurde das Inverkehrbringen dieses Gerates angezeigt und die Berechtigung zur Überprufüng der Serie auf Einhaltung der Bestimmungen eingeräumt.

John Fluke Mfg. Co., Inc.

English

Deutsch

Français

日本語

Service Centers

1020 Series

TOUCH CONTROL SCREEN

Inspection and Installation Guide

P/N 778779
April 1986 Rev. 3, 7/89
©1989 John Fluke Mfg. Co., Inc. All rights reserved. Litho in U.S.A.

FLUKE

INTERFERENCE INFORMATION

This equipment generates and uses radio frequency energy and if not installed and used in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception. It has been type tested and found to comply with the limits for a Class B computing device in accordance with the specifications in Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient the receiving antenna
- Relocate the equipment with respect to the receiver
- Move the equipment away from the receiver
- Plug the equipment into a different outlet so that the computer and receiver are on different branch circuits

If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions. The user may find the following booklet prepared by the Federal Communications Commission helpful: How to Identify and Resolve Radio-TV Interference Problems. This booklet is available from the U.S. Government Printing Office, Washington, DC 20402. Stock No. 004-000-00345-4.

Inspection and Installation Guide

INTRODUCTION

This guide contains instructions for incoming inspection and installation of the 1020 Series Touch Control Screen (TCS). In addition, a short sample program illustrates how to create active touchkeys on the TCS display. Specifications for the TCS follow the sample program.

UNPACKING

NOTE

To avoid damage to the TCS or the shipping carton, do not stack units more than four high.

Unpack all the containers and check the packing materials, then inspect the TCS for possible shipping damage. Special instructions for inspection and claims are on the inside of the front cover of this document. If inspection reveals damage or indicates that damage might have occurred, notify the shipping agent immediately.

If the TCS needs to be shipped again at a later date, use the original packing carton with all fillers properly in place. If the original packing carton is no longer available, a new carton and packing material may be ordered from Fluke. Do not reship the TCS in a container other than the original packing carton.

INSPECTING THE TCS

Verifying the Configuration Switch Settings

A rectangular cutout in the bottom to the TCS chassis provides access to the configuration switch. A decal surrounding the cutout shows the functions of the 8-position switch and provides a chart to mark the current switch settings. Normally, all switches are ON (closed, to the left) and the decal is unmarked. When a TCS is shipped from the factory in other than a standard configuration, the decal is marked. Verify that the TCS is correctly configured by comparing the decal markings to the switch settings. Re-mark the decal whenever the configuration is changed.

Preparation For Use

CAUTION

If the line voltage selection switch is in the 110 position, turning the TCS on with line voltage higher than 132V ac will damage the power supply.

1. Verify that the TCS is set to the proper voltage for local line power. The line voltage selection switch is located on the rear panel (Figure 1). In the 110 position, the TCS will operate on a line voltage between 90V ac and 132V ac. In the 220 position, the TCS will operate on a line voltage between 180V and 264V ac.

NOTE

If the TCS is set for the incorrect voltage, rotate the selection switch to the proper setting with a screwdriver.

2. Connect the line cord to the unit and to an ac outlet.

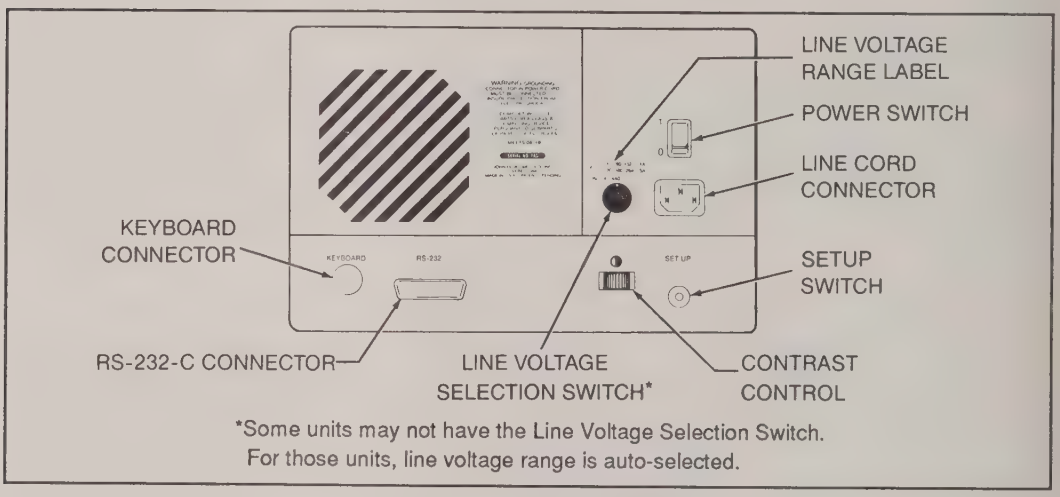


Figure 1. Rear Panel Features

Warm-Up Sequence

1. Set the TCS power switch to 1 (ON). (See Figure 1.) Do not touch the TCS screen during the warmup sequence.

   You will hear an audible beep that indicates that the unit is on and functioning.

2. Wait 10 seconds for the display to warm-up. The screen will display the message: Self-tests OK.

NOTE

During the first 5 minutes of operation, the raster may be visible on the display. This is common to CRT displays and is not a fault.

3. Adjust the contrast control on the rear panel (Figure 1) for optimum viewing.

NOTE

If no display is visible, or if a message other than "Self-tests OK" appears, call the nearest Fluke Service Representative. Note that touching the display after 5 seconds will clear the message. If this occurs before the message was read, set the power switch to 0 (OFF) and back to 1 (ON).

4. Press the SET UP switch on the rear panel (Figure 1). This will cause the Setup Screen to be displayed (Figure 2).

Touching the Touch Panel

The touch panel is designed to be actuated by a light press from a human finger. Although the touch panel has a hardened, scratch resistant surface that will withstand many years of operation, the use of hard or sharp objects should be avoided.

When touching the screen, view it from a position directly in front of the characters displayed. (See Figure 3.) Viewing from above, below, or either side of the character may result in touching the screen at other than the intended location.

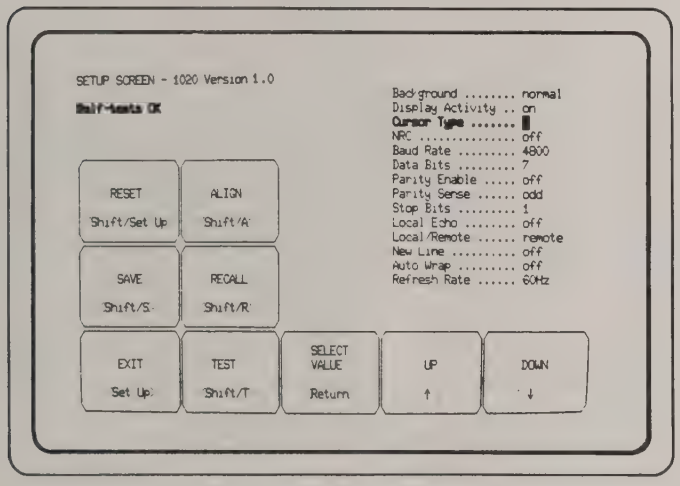


Figure 2. The Setup Screen

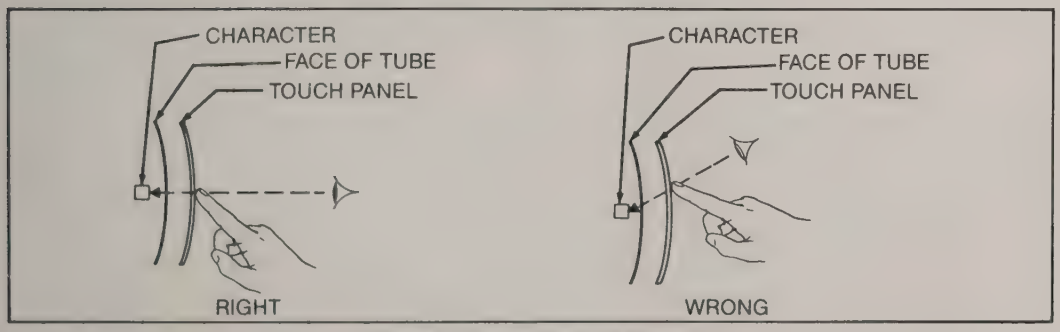


Figure 3. Viewing the TCS Screen

Verifying Alignment

The TCS display is properly aligned with the touch panel at the factory. However, alignment may need to be adjusted due to local variations in the electromagnetic field. To verify proper alignment, perform the following procedure while viewing the display from directly in front of the center of the screen, with the screen at eye-level.

1. Touch ALIGN on the Setup Screen to reach the Alignment Screen. (See Figure 4.)
2. Locate the four alignment marks in the TCS front bezel (shown in Figure 5).

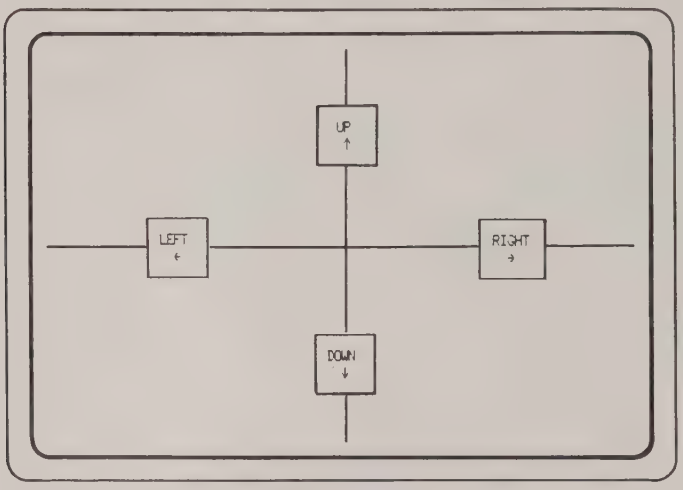


Figure 4. Alignment Screen

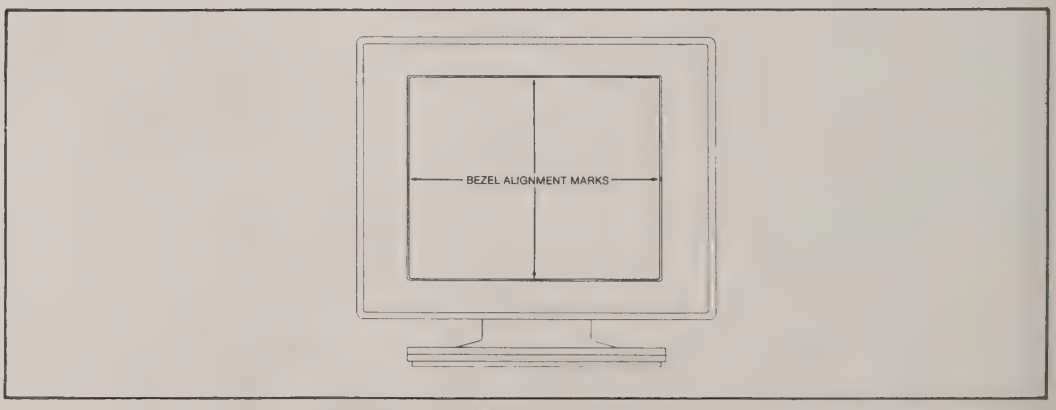


Figure 5. Front Bezel Alignment Marks

3. Press the LEFT or RIGHT touchkey on the display until the vertical cross-hair is aligned with the top and bottom bezel alignment marks. (A flexible straight-edge may be used between the bezel alignment marks.)

4. Press the UP or DOWN touchkey on the display until the horizontal cross-hair is aligned with the left and right bezel alignment marks.

5. Touch Exit on the Alignment Screen to re-enter the Setup Screen.

6. Touch SAVE on the Setup Screen to save the new display alignment.

Test Sequence

1. Press the touchkey labeled TEST to enter the Test Screen (see Figure 2).

2. Press the touchkey labeled TOUCH PANEL. The display will change to the Touch Panel Test Screen.

3. Each touchkey is displayed as a small box identified by a three-digit touch cell number. When a particular box is touched, the box alternates between normal and reverse video.

   Press all of the touchkeys along the top and bottom row and the left-most and right-most column to make sure the entire touch panel is functioning properly.

NOTE

If boxes activate without being touched or do not respond, call the nearest Fluke Service Representative.

4. Press the SET UP switch on the rear panel to exit the Touch Panel Test and return to the Test Screen.

5. Press the EXIT touchkey to return to the Setup Screen.

6. Press the EXIT touchkey to return to the normal operating mode.

Optional Keyboard Test

1. With the TCS turned off, plug the optional keyboard into the keyboard connector and turn the power on (see Figure 1).

2. Press the SET UP switch on the rear panel to enter the Setup Screen.

3. Press the TEST touchkey to enter the Test Screen (see Figure 2).

4. Press the KEYBOARD touchkey.

5. Press each key on the keyboard except the Set Up key. As each key is pressed, its corresponding image on the screen alternates between normal and reverse video.

NOTE

If boxes activate without being touched or do not respond, call the nearest Fluke Service Representative.

6. Press the Set Up key on the keyboard to return to the Test Screen.
7. Press the Set Up key again to return to the Setup Screen.
8. Press the Set Up key again to return to the normal operating mode.

Additional user-selectable tests can be performed using the Test Screen. Refer to the User's Guide for information on the additional tests.

INSTALLATION

Surface Mount

To mount the unit to a base other than the optional Fluke tilt/swivel base, use the four metal mounting points on the bottom of the unit. These points are threaded to accept 6-32 machine screws. Screw length should be equal to the thickness of the base plus a maximum of 1.85 mm (0.73 inches) and a minimum of 1.6 mm (0.63 inches) when the optional plastic enclosure is used.

Panel Mount

Use the following procedure to mount the TCS in a panel. Refer to the instructions provided with the NEMA 12 panel mounting kit if the water and dust resistant NEMA gasket is used.

1. Push the TCS into the panel cutout as shown in Figure 6. (See the Designer's Guide for more information on panel cutouts.)
2. Install one clip on the top and two clips on the bottom of the TCS chassis as shown in Figure 7.
3. Tighten the screws in the clips until the chassis is held snugly against the panel (a torque of 13.6 N-m, or 10 ft-lbs, should be sufficient).

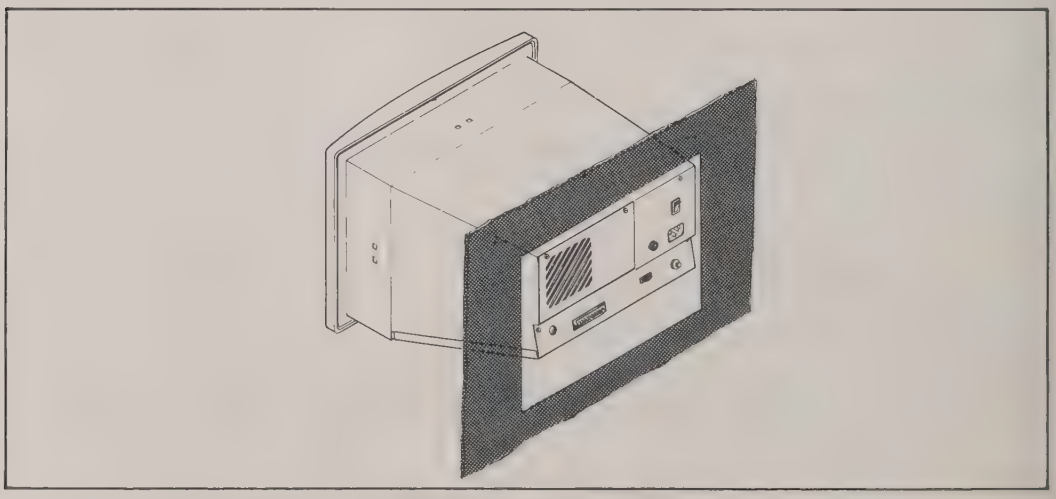


Figure 6. Installing the TCS

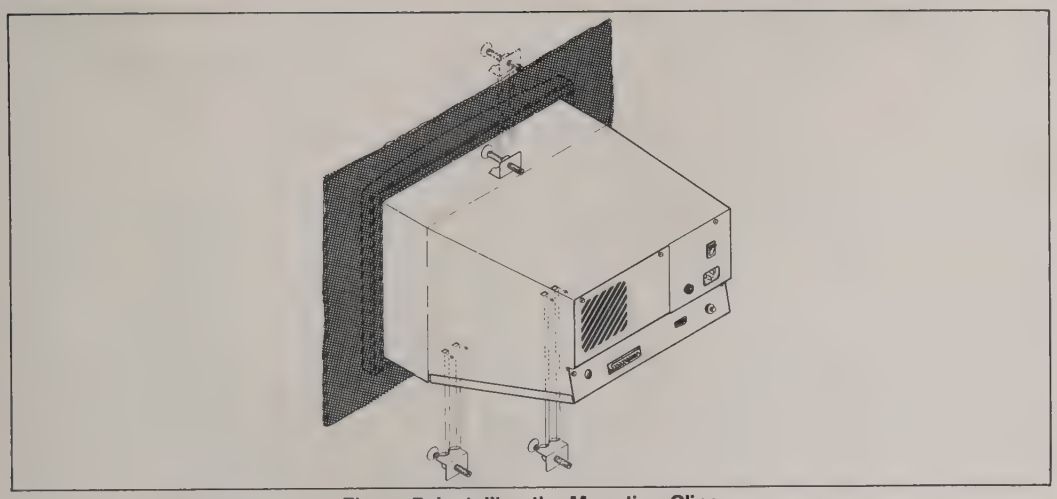


Figure 7. Installing the Mounting Clips

GETTING STARTED ON THE TOUCH CONTROL SCREEN

Connect the TCS to a Host Computer

Locate the RS-232-C serial interface port on the host computer. Determine whether the host is Data Terminal Equipment (DTE) or Data Communication Equipment (DCE). DTE is usually a computer; DCE is usually a modem.

NOTE

If the host is DTE, connect a null-modem cable between the host and the TCS. Figure 8 provides a wiring diagram for a standard null-modem cable. (The lines marked with an asterisk are the lines required for a minimum three-wire configuration.) If the host is a DCE, connect an RS-232-C cable between the modem and the TCS. Figure 9 provides a wiring diagram. (The lines marked with an asterisk are the lines required for a minimum three-wire configuration.)

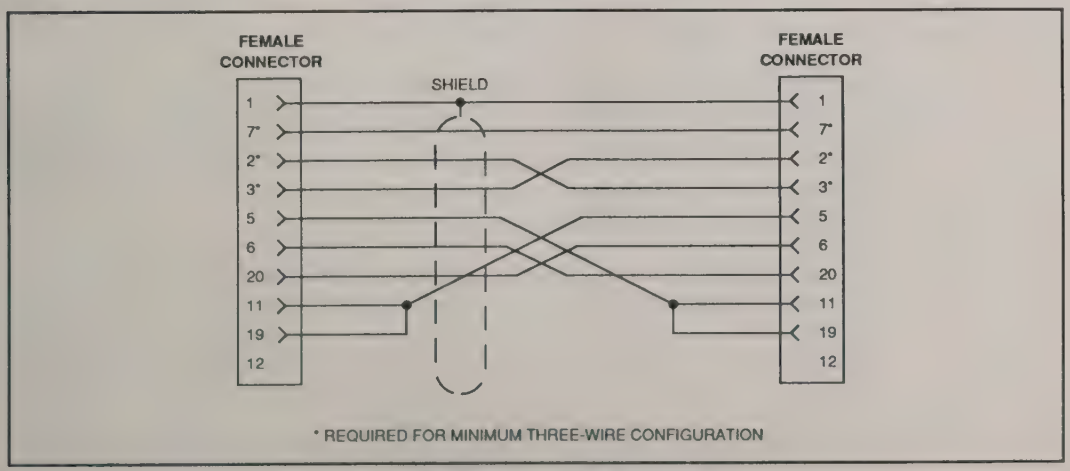


Figure 8. Null Modem Cable

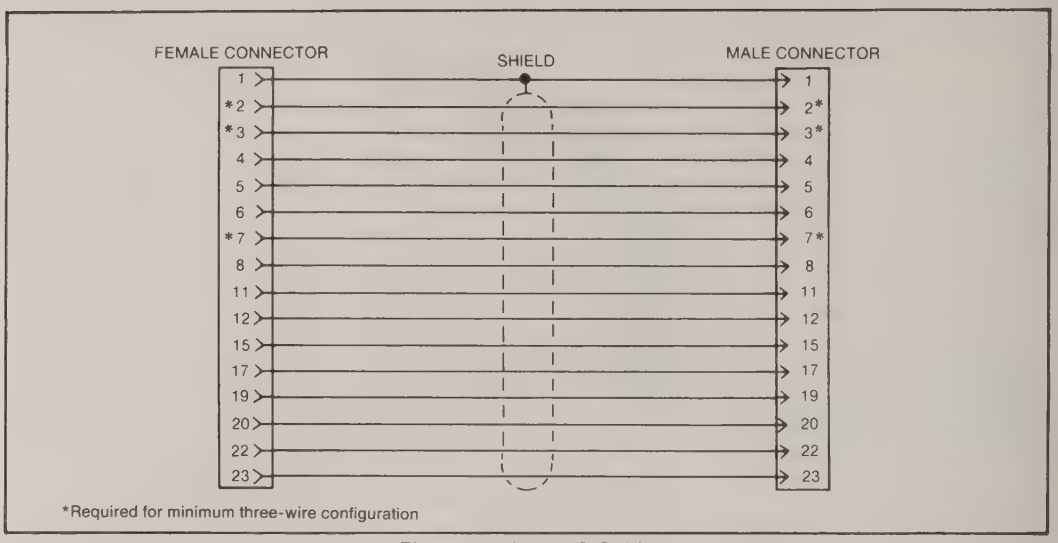


Figure 9. RS-232-C Cable

Set Communications Parameters

1. Press the SET UP switch on the rear panel of the TCS to enter the Setup Screen.

2. Use the UP, DOWN, and SELECT touchkeys to set the communications parameters to match those set for the host computer. Before running the following sample program, be sure that the TCS is configured as follows:

Display Activity	on
Baud Rate	9600
Parity Enable	off
Data Bits	8
Stop Bits	1
Local/Remote	remote

3. Exit the Setup Screen by pressing the EXIT touchkey, or by pressing the SET UP switch on the back of the unit.

Run the Sample Program

The following sample program demonstrates how to send characters and commands to the TCS from a host computer, and how to receive touch reports from the TCS. The program is written in the BASIC programming language, and is provided for both an IBM PC* and a Fluke 1722A Instrument Controller or Fluke 1752A Data Acquisition system. To make the program run on other hosts, a change in the method of opening communication channels is usually all that is required.

Communication is accomplished by sending sequences of characters between the TCS and the host. To display a message, regular alpha-numeric characters are sent to the TCS. To send a command to the TCS, a special control sequence is used. The control sequence begins with an Escape character (represented in the program by the decimal number 27).

Touch reports to the host from the TCS use similar control sequences, and also begin with an Escape character. The Escape character is necessary to differentiate commands from messages to be displayed.

NOTE

If you encounter difficulty, or if the touch cell value does not appear on the display after running the program, check to make certain that the program was entered correctly. Then check that the communication parameters of both the TCS and the host are set exactly the same. Finally, check for the proper cable type and connection.

If you need more help, see the Designer's Guide for more information on cabling, the Programmer's Guide for a discussion of communication protocols, and the User's Guide for information on using the Setup Screen to select communication parameters. If your host doesn't run BASIC, you will probably need to read the Programmer's Guide in order to become more familiar with TCS programming before attempting to run a program.

IBM PC Program

Make sure the TCS is connected to RS-232-C port COM1. (See the preceding connection instructions.) Enter BASIC and type in the program lines that follow:

1. Open a channel to the TCS and set communications parameters:

```
20 OPEN "COM1:9600,N,8,1,CS,DS,CD" AS #1        'Open channel
```

2. Have the TCS append a Carriage Return (ASCII code 13) to strings sent to host:

```
30 PRINT #1,CHR$(27);"[;;13w";        'Append ⟨CR⟩ to reports
```

3. Get touch input from TCS:

```
40 INPUT #2,IN$                       'Input string from TCS
50 K$=MID(IN$,6,3)                    'Strip out touch cell value
```

4. Print touch cell value on the TCS display:

```
60 PRINT #1, CHR$(27);"[12;32H";   'Move cursor to row 12 column 32
70 PRINT #1,"YOU TOUCHED: ";K$;    'Send touch cell value to TCS
80 GOTO 40                         'Get next touch
90 END
```

Now run the program and touch the screen on the TCS. For each touch, the touch cell value should appear on the display.

Fluke 1722A, 1752A Program

Before entering BASIC, make sure the TCS is connected to RS-232-C port KB1. (See the preceding connection instructions.) Use the Set Utility Program on the 1722A/1752A to configure the following communications parameters:

* IBM is a trademark of International Business Machines Corporation

BR (baud rate)	9600
DB (data bits)	8
PB (parity bits)	N
SB (stop bits)	1
EOL (end of line)	13
SO (stall output)	E
SI (stall input)	E

Enter BASIC and type in the program lines that follow:

1. Open a channel to the TCS:

```
10  OPEN "KB1:" AS NEW FILE 1      !Open output channel to TCS
20  OPEN "KB1:" AS OLD FILE 2      !Open input channel from TCS
```

2. Have TCS append a Carriage Return (ASCII character 13) to strings sent to host:

```
30  PRINT #1,CHR$(27);"[;;13w";    !Append 〈CR〉 to reports
```

3. Get touch input from TCS:

```
40  INPUT #1,IN                    !Input string from TCS
50  K$=MID(IN$,6,3)                !Strip out touch cell value
```

4. Print touch cell value on the TCS display:

```
60  PRINT #1, CHR$(27);"[12;32H";  !Move cursor to row 12 column 32
70  PRINT #1,"YOU TOUCHED: ";K$;   !Send touch cell value to TCS
80  GOTO 40                        !Get next touch
90  END
```

Now run the program and touch the screen on the TCS. For each touch, the touch cell value should appear on the display.

USING THE TCS

For further information about the TCS, refer to the other manuals in the 1020 Series Manual Set. The other manuals are:

- User's Guide: Contains basic operating instructions for the TCS. This guide should be read first by all TCS users.
- Programmer's Guide: Contains serial communication information and complete information on how to program the TCS. Section 9 of the Programmer's Guide contains an expanded sample program for communication between the TCS and a host computer.
- Designer's Guide: Contains mechanical, electrical and other design considerations for engineers and designers incorporating the TCS into their system. The Designer's Guide also provides TCS specifications and detailed installation instructions.

TCS SPECIFICATIONS

Specifications for the TCS are given in Table 1.

Table 1. Touch Control Screen Specifications

ENVIRONMENTAL

Temperature

Operating	0 to 50°C without plastic enclosure. 0 to 60°C without plastic enclosure, with optional fan. 0 to 40°C with plastic enclosure. 0 to 50°C with plastic enclosure, with optional fan.
Nonoperating	-40 to 75°C.

Relative Humidity

0 to 30°C	95% (Noncondensing).
30 to 40°C	75% (Noncondensing).
40 to 55°C	45% (Noncondensing).
55 to 75°C	40% (Noncondensing).

Altitude

Operating	3,050 meters (10,000 ft).
Nonoperating	12,000 meters (40,000 ft).

Power

NOTE

This is an IEC safety class 1 product. The ground wire in the line cord must be connected for safety.

Voltage	90 to 132V ac, 47 to 440 Hz; 180 to 264V ac, 47 to 440 Hz.
Safety Ground Leakage Current	Less than 0.5 mA at 47 to 63 Hz. Less than 3.5 mA at 63 to 440 Hz.
Power Consumption	Less than 50 watts. Less than 1A rms at 90 to 132V ac. Less than 0.5A rms at 180 to 264V ac.
Vibration	Meets the requirements of MIL-T-28800C, class 3.

FREQUENCY	FORCE	DOUBLE AMPLITUDE
5-15 Hz	0.7G at 15 Hz	1.52 mm (0.06 inch)
15-25 Hz	1.3G at 25 Hz	1.02 mm (0.04 inch)
25-55 Hz	3G at 55 Hz	0.51 mm (0.02 inch)

Shock	1/2 sine shock of 30G for 11 ms ±1 ms.
Dust-tight and Drip-tight	Suitable for use in NEMA Type 12 enclosure with optional NEMA 12 Panel Mounting Kit.

PACKAGING

Dimensions	335.3 mm (13.2 in) wide; 260.9 mm (10.27 in) high; 318 mm (12.5 in) deep without enclosure; 330 mm (13.0 in) deep with enclosure.

Table 1. Touch Control Screen Specifications (cont)

Minimum Mounting Depth	300 mm (11.8 in) from back of bezel to back of TCS, without cables. 381 mm (15.0 in) with Fluke cables.
Weight	8.44 kg (18.6 lbs) without plastic enclosure.
Enclosure	1.59 kg (3.5 lbs).
Tilt/Swivel Base	0.68 kg (1.5 lbs).
Panel Mount	Three point mounting clips provided.
Rack Mount (optional)	482.6 mm (19.0 in) wide. 265.9 mm (10.5 in) high, six rack units.
Tilt/Swivel Base (optional)	Forward tilt of up to 5 degrees. Backward tilt of up to 15 degrees.
TOUCH PANEL	
Type	Membrane switch matrix.
Number of Touch Cells	12 rows, 10 columns, extending to the edge of the display.
Touch Cell Size	2 rows, 8 columns of single size characters.
Resistance to Damage	Hardened scratch-resistant surface.
Light Transmissibility	Greater than 60 percent.
Optical Characteristics	Antiglare standard.
CRT	
Tube Size	305 mm (12 in), measured diagonally.
Tube Type	Monochrome P31 phosphor (green) standard. Monochrome PC194 phosphor (amber) optional.
DISPLAY CHARACTERISTICS	
Scanning Method	Non-interlaced raster.
Refresh	50/60 Hz, programmable, stored in non-volatile memory.
Active Display Size	203 mm (8 in) wide, 137 mm (5.4 in) high.
Character Cells on Screen	24 lines of 80 characters.
Dots per Character Cell	8 dots wide, 10 dots high.
Line Attributes	Normal, double width, double size.
Character Attributes	Normal, highlight, underline, blink, reverse video.
Character Set Size	256 characters (includes ASCII characters).
International Characters	Provided using National Replacement Code (NRC) method
Display Alignment	Programmable; stored in non-volatile memory. Horizontal adjustment range: 12 characters, 1 character resolution. Vertical adjustment range: 2.4 characters, (24 scan lines), 0.1 character (1 scan line) resolution.
Display Geometry	Horizontal line fits within 2.54 mm (0.1 in) slot, vertical line fits within 1.25 mm (0.05 in) slot.

Table 1. Touch Control Screen Specifications (cont)

BEEPER

Frequency	2.1 kHz.
Loudness	Two levels and off, switch selectable.

KEYBOARD (optional)

Length	470.2 mm (18.51 in).
Width	211.5 mm (8.33 in).
Maximum Total Height	50.8 mm (2.0 in), includes keycaps.
Weight	1.59 kg (3.5 lb).

STANDARDS

The Touch Control Screen is designed to comply with the following safety standards:

ANSI/UL	478	Standard for Electronic Data Processing Units and Systems
IEC	348	Safety Requirement for Electronic Measuring Apparatus.
IEC	435	Safety of Data Processing Equipment.
CSA	556B	Certification Requirements for Electronic Instruments and Scientific Apparatus.

The TCS has been verified to comply with the following EMI (electromagnetic interference) standards:

FCC	Part 15, subpart J	Computing Devices (class B).
VDE	0871	Radio Frequency Interference Suppression of Radio Frequency Equipment for Industrial, Scientific and Medical and Similar Purposes (class B).

Anleitung für Wareneingangsprüfung und Inbetriebnahme

EINFÜHRUNG

Die folgenden Hinweise dienen der Wareneingangsprüfung und ersten Inbetriebnahme des 1020 TCS (Tastschirmterminal). In einem kurzen Programmierbeispiel wird außerdem dargestellt, wie aktive Tasten auf dem Schirm erzeugt werden. Technische Daten für den Tastbedienschirm befinden sich im Anhang dieser Anleitung.

AUSPACKEN

ANMERKUNG

Um eine Beschädigung des Gerätes und auch der Verpackung zu vermeiden, sollten niemals mehr als vier Einheiten aufeinander gestapelt werden.

Nach dem Auspacken sind Verpackungsmaterial und Geräte auf mögliche Transportschäden hin zu untersuchen. Hinweise für die Prüfung und die Meldung von Schäden sind auf der Innenseite des Umschlages dieser Broschüre zu finden. Werden Schäden festgestellt oder gibt es Anzeichen dafür, daß eine Beschädigung eingetreten sein könnte, so ist unverzüglich das Transportunternehmen zu benachrichtigen.

Soll das Gerät später wieder verschickt werden, so ist die Originalverpackung mit allen Füllteilen zu verwenden. Ist die Originalverpackung nicht mehr auffindbar, so kann ein neuer Karton und Verpackungsmaterial von FLUKE bestellt werden. Bitte kein Gerät in einer anderen als der Originalverpackung zurücksenden!

PRÜFUNG DES GERÄTES

Prüfung der Einstellungen des Konfigurationsschalters

Der Konfigurationsschalter ist durch eine rechteckige Öffnung am Boden des TCS Gehäuses erreichbar. Ein die Öffnung umgebendes Klebebild zeigt die Funktionen der 8 Einstellungen des Schalters an. Auf ihm können auch die augenblicklichen Einstellungen markiert werden. Normalerweise stehen alle Schalter auf ON (geschlossen). Dann ist das Klebebild unmarkiert. Wird ein TCS von der Fabrik mit einer anderen als der Standardkonfiguration versandt, ist das Klebebild markiert. Die richtige Konfiguration kann durch Vergleich der Klebebildmarkierungen mit der Schaltereinstellung festgestellt werden. Wird die Konfiguration geändert, muß das Klebebild neu markiert werden.

Vorbereitungen

ACHTUNG

Wird der TCS an einer Netzspannung von mehr als 132 V bei 110 V Spannungswahl in Betrieb genommen, so wird das Netzteil beschädigt.

1. Zuerst ist zu prüfen, ob die richtige Netzspannung gewählt wurde. Der Schalter für die Netzspannungswahl befindet sich an der Rückseite des Gerätes (Bild 1). In der 110 V Stellung ist der Betrieb an Netzen zwischen 90 V und 132 V möglich, in der 220 V Position entsprechend an 180 V bis 264 V.

ANMERKUNG

Steht der Wahlschalter nicht auf der richtigen Spannung, so kann der Wahlschalter mit einem Schraubenzieher auf die richtige Einstellung gedreht werden.

2. Nachdem das Netzkabel in das Gerät eingesteckt ist, kann das Gerät an das Netz angeschlossen werden.

Anwärmfolge

1. Netzschalter auf 1 (AN) stellen. Den TCS während des Aufwärmens nicht berühren. Wenn ein Piepen ertönt ist das Gerät funktionsbereit.

2. 10 Sek auf das Anwärmen des Anzeigeschirms warten. Der Schirm zeigt dies mit «Self-tests OK» an.

ANMERKUNG

Während der ersten fünf Minuten des Betriebs wird die Rasterung sichtbar sein. Dies ist allgemein so bei Schirmen dieser Art und keine Fehlfunktion.

3. Die Kontrasteinstellung auf der Geräterückseite (Bild 1) dient zur Optimierung der Darstellung.

ANMERKUNG

Erscheint keine Anzeige oder ist die Mitteilung auf dem Schirm eine andere als «self-tests OK», so muß der nächste FLUKE Repräsentant angerufen werden. Ein Berühren des Schirms fünf Sekunden, nachdem die Nachricht erschienen ist, löscht die Mitteilung. Geschieht dies bevor die Mitteilung gelesen wurde, bitte Gerät noch einmal auf 0 (AUS) und wieder auf 1 (EIN) schalten.

4. Drückt man den Einstellknopf (SET UP) auf der Geräterückseite (Bild 1), so erscheint das Einstellmenü (Bild 2).

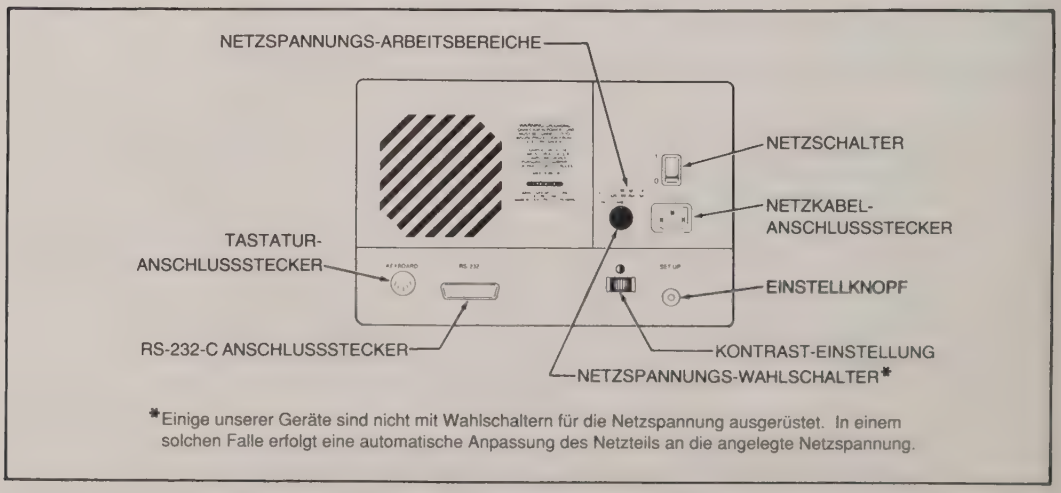


Bild 1. Geräterückansicht

Betätigen der Bildschirmtastatur

Der Tastschirm wird durch leichten Druck des Fingers bedient. Obwohl der Schirm eine vergütete kratzunempfindliche Oberfläche hat, die viele Jahre rauhen Betriebs widersteht, sollten harte, spitze Gegenstände nicht für die Betätigung verwendet werden.

Beim Betätigen des Schirms sollte senkrecht auf die Darstellung gesehen werden (Bild 3), sonst kann es infolge von Parallaxe zu Fehlbedienungen kommen.

Überprüfen der Einstellung

Die TCS-Anzeige ist in der Fertigung genau mit den Tastenfeldern ausgerichtet worden. Manchmal muß die Überdeckung nachjustiert werden, die Ursache dafür kann ein elektromagnetisches Feld sein. Um die richtige Einstellung zu überprüfen, ist die folgende Vorgehensweise empfehlenswert. Dazu muß die Anzeige von vorn, zentrisch zum Schirm, Schirm in Augenhöhe, betrachtet werden.

1. Tippe auf das ALIGN des Einstellmenüs. Die Darstellung für die Ausrichtung erscheint dann (Bild 4).
2. Finde die Einstellmarkierungen am Rahmen des Schirms (Bild 5).
3. Drücke das Tastfeld LEFT (links) oder RIGHT (rechts) auf dem Schirm, bis vertikale Linie des Fadenkreuzes sich direkt mit den oberen und den unteren Einstellmarken deckt. (Man kann ein flexibles Lineal zwischen der Einstellmarke anlegen.)

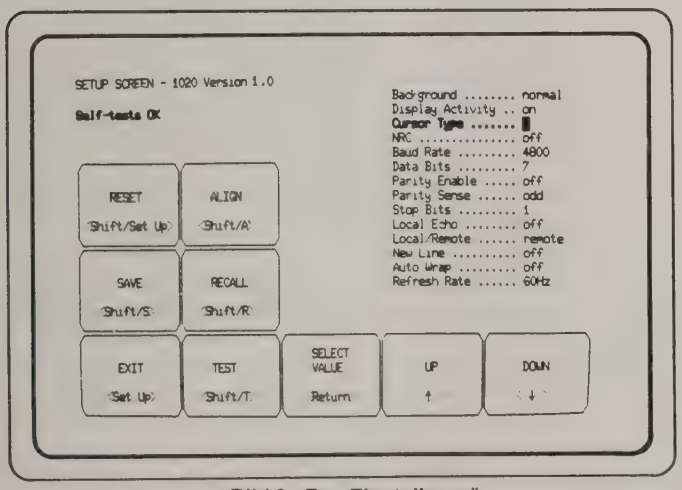


Bild 2. Das Einstellmenü

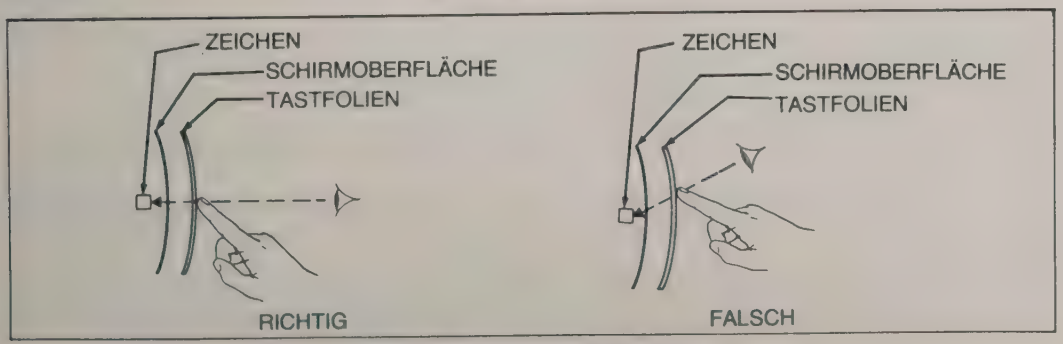


Bild 3. Betrachten des Bildschirms

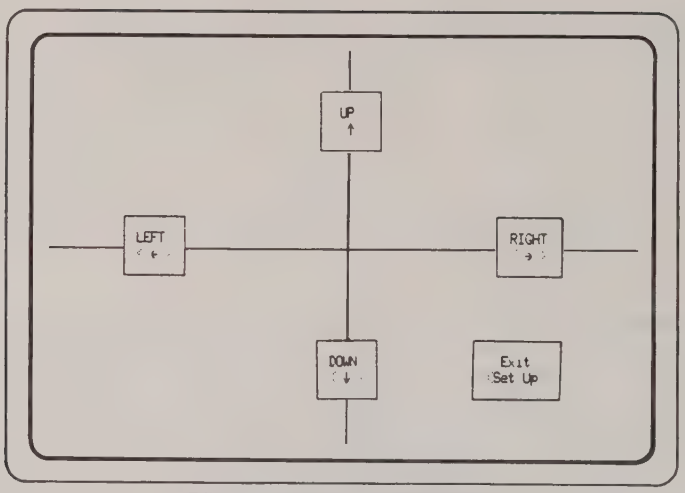


Bild 4. Anzeige zur Bildjustage

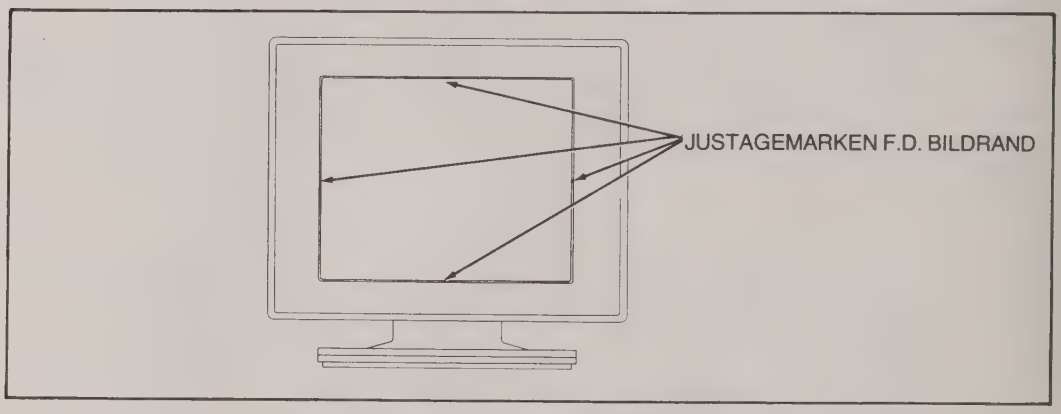


Bild 5. Anzeige der Bildrand-Justagemarken

4. Drücke das Tastfeld UP (hinauf) oder DOWN (hinunter), bis die horizontale Linie des Fadenkreuzes sich direkt mit den linken und den rechten Einstellmarken des Rahmens deckt.
5. Drücke EXIT (hinaus) auf dem Ausrichtmenü und das Einstellungsmenü erscheint wieder.
6. Drücke SAVE (sichern) im Einstellungsmenü, um die erreichte Ausrichtung festzuhalten.

Testfolge

1. Drücke TEST, um in den Testbetrieb zu kommen (Bild 2).
2. Drücke TOUCH PANEL (Tastenfeld). Die Darstellung wechselt zum Tastenfeldtest.
3. Jede Taste ist als kleiner Kasten dargestellt und mit einer dreiziffrigen Tastennummer versehen. Wird eine Taste gedrückt, so wechselt sie von normal zu invers Video.

   Drücke alle Tasten rings um den Schirm um zu prüfen, ob das gesamte Tastenfeld richtig funktioniert.

ANMERKUNG

Aktivieren sich Tasten, ohne gedrückt zu werden, oder reagieren Tasten nicht auf das Drücken, so muß der nächste FLUKE Service angerufen werden.

4. Drücke die SET UP (Einstellung) Taste auf der Geräterückseite, um den Tastenfeldtest zu verlassen und in das Testmenü zurückzukehren.

5. Drücke EXIT, um in das Einstellmenü zu kommen.

6. Drücke EXIT, um in den Normalbetrieb zu gelangen.

Tastaturtest (optionell)

1. Bei ausgeschaltetem Gerät wird die optionale Tastatur mit dem Gerät verbunden, dann wird das Gerät eingeschaltet.

2. Drücke SET UP (Einstellung) an der Geräterückseite, um in das Einstellmenü zu kommen.

3. Drücke TEST, um in das Testmenü zu kommen (Bild 2).

4. Drücke die KEYBOARD (Tastatur) Taste.

5. Drücke jede Taste auf der Tastatur außer der Einstellungstaste. Jede gedrückte Taste wechselt dann von normaler zu inverser Videodarstellung.

ANMERKUNG

Wenn Tasten ansprechen, ohne betätigt zu sein, oder nicht reagieren, bitte den nächsten FLUKE-Service verständigen.

6. Drücke die Einstellungstaste der Tastatur, um in das Testmenü zurückzukehren.

7. Drücke die Einstellungstaste noch einmal, um in das Einstellungsmenü zu kommen.

8. Nach abermaligem Drücken der Einstellungstaste ist der Normalbetrieb wieder erreicht.

Weitere Tests können vom Anwender mit Hilfe des Testmenüs gewählt werden. Die entsprechende Information ist im Handbuch enthalten.

INSTALLATION

Einbau

Um das Gerät ohne den FLUKE Schwenkfuß zu montieren, müssen die vier Montagepunkte an der Unterseite des Gehäuses benutzt werden. Die Punkte haben ein 6/32 Zoll Gewinde. Die Länge der benutzten Schrauben sollten der Wandstärke der Basisplatte entsprechen plus 1,85 mm. Wird das optionale Plastikgehäuse verwendet, sollten die Schrauben minimal 1,6 mm überstehen.

Gestelleinbau

Um das Gerät in eine Frontplatte für Gestellmontage einzubauen, ist wie folgt vorzugehen. Soll das Gerät mit der wasser- und staubdichten Dichtung eingesetzt werden, so sind die mitgelieferten Hinweise zu beachten.

1. Schiebe das TCS in den Frontplattenausschnitt entsprechend Bild 6 (die Hinweise für den Konstrukteur enthalten hierzu nähere Einzelheiten).

2. Bringe eine Klammer an der Oberseite und zwei an der Unterseite des Gerätes an, wie in Bild 7 gezeigt.

3. Ziehe die Schrauben in den Klammern soweit an, bis das Gerät fest an der Frontplatte anliegt (Drehmoment entspricht 13,6 Nm).

INBETRIEBNAHME DES TASTSCHIRMTERMINALS

Anschluß des TCS an einen Zentralrechner (host)

Identifiziere das RS-232-C serielle Interface des Rechners. Stelle fest, ob der Rechner ein Datenendgerät (DTE) oder ein Datenkommunikationsgerät (DCE) ist. DTE ist üblicherweise ein Rechner. DCE ist ein Modem.

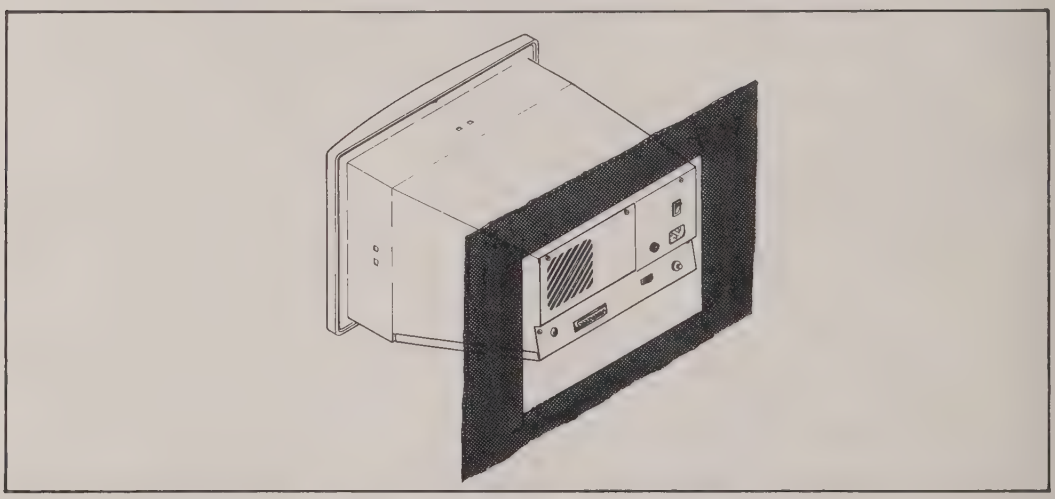


Bild 6. Montage des Tastschirmterminals

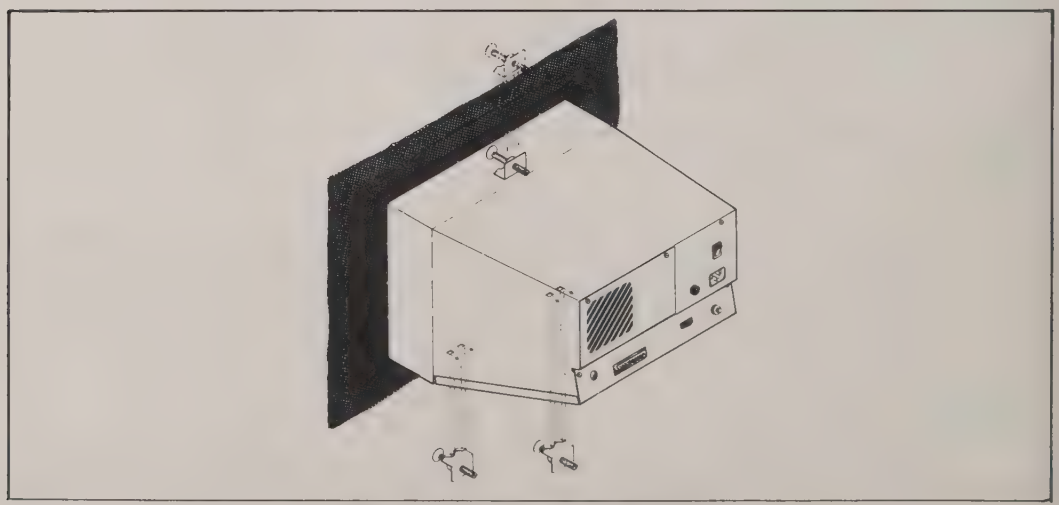


Bild 7. Anbringen der Halteklammern

ANMERKUNG

Ist der Zentralrechner ein Endgerät, so muß ein Nullmodemkabel zwischen dem Rechner und dem TCS verwendet werden. Bild 8 stellt die Steckerbelegung eines Standard-Nullmodemkabels dar. (Die Adern mit Sternchen sind die für eine minimale Dreidraht-Verbindung erforderlichen.) Ist der Zentralrechner ein Datenübertragungsgerät, so wird ein RS-232-C-Kabel zwischen Modem und TCS verwendet. Bild 9 zeigt die Steckerbelegung. (Die Adern mit Sternchen sind die für eine minimale Dreidraht-Verbindung erforderlichen.)

Wahl der Übertragungsparameter

1. Betätige den SET UP-Schalter an der Geräterückseite, um in das Einstellungmenü zu kommen.

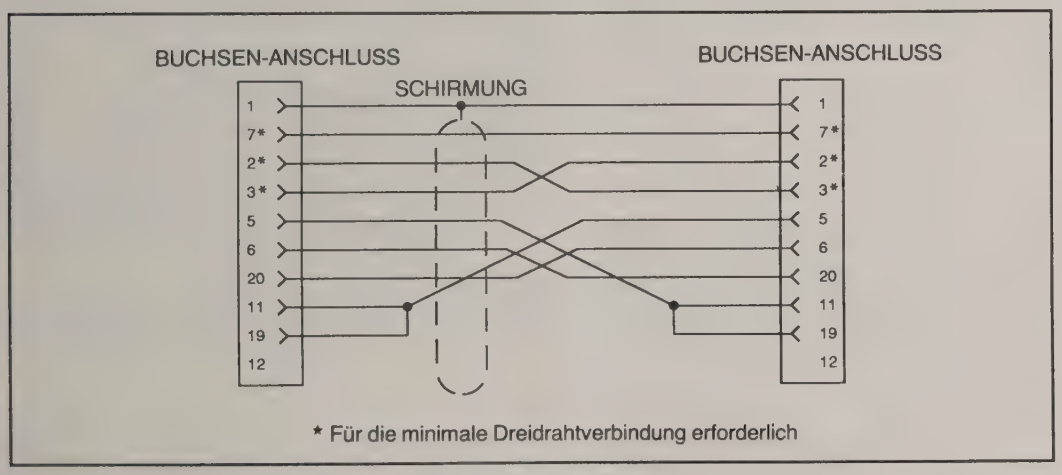


Bild 8. Nullmodemkabel

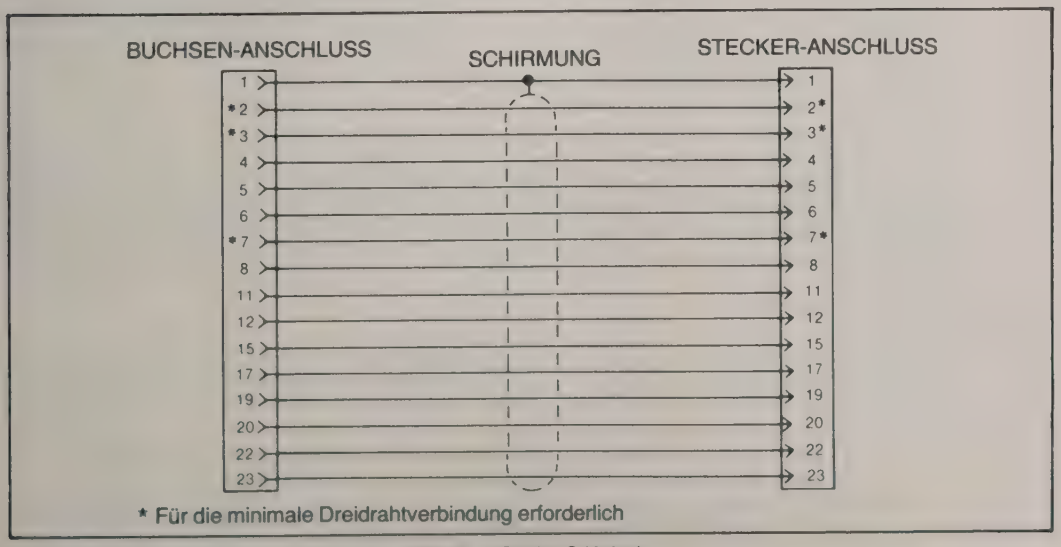


Bild 9. RS-232-C Kabel

2. Betätige «UP», «DOWN» und «SELECT» Schirmtasten, um die Übertragungsparameter dem Zentralrechner entsprechend einzustellen. Vor dem Probelauf des Beispielprogrammes sollte festgestellt werden, daß folgende Einstellungen vorhanden sind:

Display Activity	on
Baud Rate	9600
Parity Enable	off
Data Bits	8
Stop Bits	1
Local/Remote	remote

3. Verlasse das Einstellungsmenü durch Betätigen der EXIT Schirmtaste oder des SET-UP-Schalters an der Geräterückseite.

Programmbeispiel

Das folgende Programmbeispiel stellt dar, wie Zeichen und Befehle vom Zentralrechner zum TCS gesendet werden und wie Quittierungen vom TCS empfangen werden. Das Programm ist in BASIC geschrieben und gilt einmal für den IBM PC* und zum anderen für den FLUKE 1722A Instrumentenkontroller bzw. für das FLUKE 1752A Meßdatenerfassungssystem. Um dieses Programm auf einem anderen Rechner zu verwenden, müssen meist lediglich die Datenübertragungskanäle anders angesprochen werden.

Kommunikation wird erreicht durch das Senden von Zeichensequenzen zwischen TCS und Rechner. Um eine Nachricht darzustellen, werden alpha-numerische Zeichen zum TCS gesendet. Um einen Befehl zum TCS zu senden, wird eine spezielle Steuersequenz benutzt. Die Steuersequenz beginnt mit einem Escape-Zeichen (im Beispiel die Dezimalzahl 27).

Die Quittierung von TCS zum Rechner benutzt ähnliche Steuersequenzen und beginnt ebenfalls mit einem Escape-Zeichen. Das Escape (Umschalt)-Zeichen ist notwendig, um Befehle von Nachrichten, die dargestellt werden sollen, zu unterscheiden.

ANMERKUNG

Bei Schwierigkeiten, z.B. wenn ein Schirmtastenwert nicht auf dem Schirm erscheint nachdem das Programm durchlaufen ist, sollte zunächst geprüft werden, ob das Programm korrekt eingegeben wurde. Dann muß geprüft werden, ob am TCS und Zentralrechner exakt gleiche Übertragungsparameter eingestellt sind. Zuletzt muß auch überprüft werden, ob das richtige Kabel und die richtige Verbindung gewählt wurden.

Sollte all dies nicht reichen, so gibt der «Designer's Guide» nähere Auskunft über die Verdrahtung und der «Programmer's Guide» über Übertragungsprotokolle. Ferner gibt das Anwender-Handbuch «User's Guide» Hinweise zum Einstellungsmenü und die Wahl der Übertragungsparameter. Läuft der Zentralrechner nicht unter BASIC, so muß das Programmierhandbuch benutzt werden, um die Eigenheiten der TCS-Programmierung nachzulesen.

Programm für IBM PC

Zunächst überprüfen, ob der TCS über dem RS-232-C Eingang COM 1 angeschlossen ist (siehe Anschlußhinweise weiter vorn). Gehe in BASIC und tippe folgende Programmzeilen:

1. Öffne den Übertragungskanal zum TCS und wähle die Übertragungsparameter:

```
20 OPEN "COM1:9600,N,8,1,CS,DS,CD" AS #1          'Öffne Kanal
```

* IBM PC ist ein eingetragenes Warenzeichen der Fa. International Business Machines Corporation

2. Lasse den TCS eine Zeilenrückstellung (Carriage Return) den zum Zentralrechner gesendeten Strings hinzufügen (ASCII Zeichen 13):

```
30  PRINT #1,CHR$(27);"[;;13w";      'Füge ⟨CR⟩ an alle Befehlsfolgen
```

3. Aktiviere Schirmtastatur:

```
40  INPUT #1,IN$                     'Befehl vom TCS
50  K$=MID$(IN$,6,3)                 'Lösche Schirmtastenwert
```

4. Zeige den Schirmtastenwert auf dem TCS:

```
60  PRINT #1, CHR$(27);"[12;32H";    'Stelle Positionszeiger (Cursor) auf
65                                   'Zeile 12 Spalte 32
70  PRINT #1,"YOU TOUCHED: ";K$;     'Sende Schirmtastenwert zum TCS
80  GOTO 40                          'Nimm nächsten Tastendruck
90  END                              'Ende
```

Nun kann das Programm laufen und die Tastatur auf dem TCS betätigt werden. Für jeden Tastendruck sollte der Schirmtastenwert angezeigt werden.

Programm für FLUKE 1722A/1752A

Zunächst überprüfen, ob der TCS über RS-232-C-Eingang KB 1 angeschlossen ist (siehe Anschlußhinweise weiter vorn). Gebrauche das Nutzungswahlprogramm (Set Utility Program) des 1722A/1752A, um die Übertragungsparameter einzustellen.

BR (baud rate)	9600
DB (data bits)	8
PB (parity bits)	N
SB (stop bits)	1
EOL (end of line)	13
SO (stall output)	E
SI (stall input)	E

Nun in BASIC gehen und folgende Programmzeilen eintippen:

1. Öffne den Übertragungskanal zum TCS:

```
10  OPEN "KB1:" AS NEW FILE 1        !Öffne Ausgangskanal zum TCS
20  OPEN "KB1:" AS OLD FILE 2        !Öffne Eingangskanal vom TCS
```

2. Zeilenrückstellung ⟨CR⟩ an gesendete Strings anfügen:

```
30  PRINT #1,CHR$(27);"[;;13w";      !Füge ⟨CR⟩ an alle Befehlsfolgen
```

3. Aktiviere Schirmtasten:

```
40  INPUT #2,IN$                     !Eingangsbefehl TCS
50  K$=MID(IN$,6,3)                  !Lösche Schirmtastenwert
```

4. Stelle Schirmtastenwert auf dem TCS dar:

```
60  PRINT #1, CHR$(27);"[12;32H";   !Stelle Positionszeiger auf Zeile 12
65                                  !Spalte 32
70  PRINT #1,"YOU TOUCHED: ";K$;    !Sende Schirmtastenwert zum TCS
80  GOTO 40                         !Nimm nächsten Tastendruck
90  END                             !Ende
```

Nun kann das Programm laufen und die Schirmtasten können betätigt werden. Für jeden Tastendruck sollte der Schirmtastenwert auf dem Schirm dargestellt werden.

GEBRAUCH DES TCS

Für weitere Informationen zum TCS stehen die anderen Handbücher zur 1020-Serie zur Verfügung. Die anderen Handbücher sind:

- User's Guide (Anwender Handbuch):
  Dies enthält alle grundlegenden Bedienungshinweise. Das Handbuch sollte von allen Anwendern vor Inbetriebnahme des ersten Gerätes gelesen werden.

- Programmer's Guide (Programmierer Handbuch):
  Enthält Informationen über serielle Übertragungstechnik und umfassende Informationen zur Programmierung des TCS. Sektion 9 des Programmierer Handbuchs enthält ein umfangreiches Programmbeispiel für die Kommunikation zwischen TCS und Zentralrechner.

- Designer's Guide (Entwickler Handbuch):
  Enthält alle Einzelheiten zur mechanischen, elektrischen und sonstigen Auslegung des Gerätes, und dient damit dem Systemintegrator. Dieses Handbuch enthält alle TCS-Spezifikationen und detaillierte Installationsanweisungen.

TCS – SPEZIFIKATIONEN

Alle Spezifikationen werden in Tabelle 1 genannt.

Tabelle 1. TCS – Spezifikationen

UMGEBUNGSBEDINGUNGEN

Temperatur

Betrieb	0 bis 50°C ohne Plastikgehäuse 0 bis 60°C ohne Plastikgehäuse, mit optionellem Lüfter 0 bis 40°C mit Plastikgehäuse 0 bis 50°C mit Plastikgehäuse, mit optionellem Lüfter
Lagerung	–40 bis 75°C

Relative Luftfeuchtigkeit

0 bis 30°C	95% (Nichtkondensierend)
30 bis 40°C	75% (Nichtkondensierend)
40 bis 55°C	45% (Nichtkondensierend)
55 bis 75°C	40% (Nichtkondensierend)

Höhe

Betrieb	3,050 m
Lagerung	12,000 m

Netzversorgung

ANMERKUNG
Dies ist ein Gerät gemäß IEC-Sicherheits-Klasse 1.
Die Erdleitung des Netzkabels muß verbunden sein.

Spannung	90 bis 132 V ac, 47 bis 440 Hz 180 bis 264 V ac, 47 bis 440 Hz
Masseleckstrom	größer 0,5 mA von 47 bis 63 Hz größer 3,5 mA von 63 bis 440 Hz
Leistungsaufnahme	größer 50 Watt größer 1 A eff. von 90 bis 132 V ac größer 0,5 A eff. von 180 bis 264 V ac
Vibration	entspricht MIL-T-28800C, Klasse 3

FREQUENZ	BESCHLEUNIGUNG	DOPPELTE AMPLITUDE
5–15 Hz	0,7 G bis 15 Hz	1,52 mm
15–25 Hz	1,3 G bis 25 Hz	1,02 mm
25–55 Hz	3 G bis 55 Hz	0,51 mm

Stoß	1/2 Sinus von 30 G für 11 ms ± 1 ms
Staub- und spritzwasserdicht	geeignet für NEMA Type 12 Gehäuse mit NEMA 12 Frontplattenmontagesatz

BAUFORM

Dimensionen	335,3 mm breit 260,9 mm hoch 318 mm tief, ohne Gehäuse 330 mm tief mit Gehäuse

Tabelle 1. TCS — Spezifikationen (Fortgesetzt)

Minimale Einbautiefe	300 mm vom Einbaurahmen zur Geräterückseite, ohne Kabel 381 mm mit Fluke-Kabel
Gewicht	8,44 kg mit Plastikgehäuse
Gehäuse	1,59 kg
Schwenkfuß	0,68 kg
Frontplattenmontage	Dreipunktmontageklammern
Gestellmontage (optionell)	482,6 mm breit 265,9 mm hoch, 6 E
Schwenkfuß (optionell)	Vorneigung bis 5 Grad Rückneigung bis 15 Grad
SCHIRMTASTATUR	
Typ	Membran Schaltmatrix
Zahl der Schirmtasten	12 Reihen, 10 Spalten bis zum Schirmrand
Tastengröße	2 Zeilen, 8 Zeichen
Widerstandsfähigkeit	Oberfläche kratzsicher
Transparenz	60% lichtdurchlässig
Optische Eigenschaften	entspiegelt
KATHODENSTRAHLRÖHRE	
Röhrengröße	305 mm, diagonal gemessen
Röhrentyp	Monochrom P31 Phosphor (grün). Standard Monochrom PC194 Phosphor (bernstein), optionell
ANZEIGE-EIGENSCHAFTEN	
Ablenkart	Nicht überlappendes Raster
Wiederholfrequenz	50/60 Hz, wählbar, gespeichert im nicht flüchtigen Speicher
Aktive Anzeigenfläche	203 mm breit, 137 mm hoch
Zeichen/Schirm	24 Zeilen mit 80 Zeichen
Punkte/Zeichen	8 dots breit, 10 dots hoch
Zeilenattribute	Normal doppelt breit, doppelte Größe
Zeichenattribute	Normal aufgehellt, unterstrichen, blinkend, invers Video
Zeichensatz	256 Zeichen / incl. ASCII
Internationale Zeichen	vorhanden gemäß NRC-Ersatzmethode
Geometrieabgleich	Programmierbar gespeichert im nicht flüchtigen Speicher, Justagebereich horizontal 12 Zeichen, 1 Zeichen Auflösung, vertikal 2,4 Zeichen, Auflösung: 0,1
Anzeige-Geometrie	Horizontal 2,54 mm, vertikal 1,25 mm Rastring

Tabelle 1. TCS — Spezifikationen (Fortgesetzt)

PIEPER

Frequenz	2,1 Hz
Lautstärke	Zwei Lautstärken, Schalter wählbar

TASTATUR (optionell)

Länge	470,2 mm
Breite	211,5 mm
Gesamthöhe	50,8 mm incl. der Tastenkappen
Gewicht	1,59 kg

STANDARDS

Der TCS entspricht folgenden Sicherheitsstandards:

ANSI/UL	478	Standard für EDV-Geräte und Systeme
IEC	348	Sicherheitsvorschrift für elektronische Meßgeräte
IEC	435	EDV-Geräte-Sicherheit
CSA	556 B	Zertifikations-Anforderungen für elektronische Geräte und wissenschaftliche Apparaturen

Der TCS entspricht folgenden Anforderungen bezüglich Störstrahlung und Störspannung:

FFC	Teil 15, Absatz J	Rechnerteile Klasse B
VDE	0871	HF-Störunterdrückung für HF-Geräte in Industrie, Wissenschaft, Medizin und ähnlichen Anwendungen (Klasse B)

Guide pour la réception et la mise en service de l'écran tactile série 1020

INTRODUCTION

Ce guide contient les instructions à suivre lors de la livraison et de la première mise en service de l'écran tactile série 1020 Touch Control Screen (TCS)*.

Quelques exemples de programmes et ses spécifications y sont ajoutés.

DEBALLAGE

PRECAUTION

Pour éviter d'endommager le TCS ou son emballage, n'en empilez pas plus de quatre l'un sur l'autre.

Vérifiez en premier lieu les cartons d'emballage et les matériaux de protection. Inspectez ensuite le TCS pour s'assurer de l'absence de dommage dû au transport. En cas d'endommagement visible ou de soupçon de dégât interne, notifiez le immédiatement au transporteur.

Si le TCS doit être expédié ultérieurement, conservez son emballage d'origine. Si celui-ci n'est plus disponible, un conteneur neuf peut être commandé chez FLUKE. Ne le réexpédiez pas dans un conteneur non semblable à celui d'origine.

VERIFICATION DU TCS

POUR VERIFIER LES REGLAGES DE COMMUTATION DE LA CONFIGURATION

Un évidement rectangulaire situé au bas du châssis du TCS permet l'accès au commutateur de la configuration. Une décalcomanie entourant l'évidement désigne les fonctions du commutateur à 8 positions et fournit un graphique pour marquer les réglages en vigueur. En fonctionnement normal, tous les interrupteurs sont sur ON (fermés) et la décalcomanie est sans légende. Lorsque le TCS est expédié de l'usine dans une configuration autre que standard, la décalcomanie porte une légende. Vérifiez si le TCS est configuré correctement en comparant la légende de la décalcomanie aux réglages des interrupteurs. Marquez celle-ci à chaque fois que la configuration est modifiée.

* l'expression écran tactile a été choisie pour traduire Touch Control Screen, son sigle TCS est par contre conservé.

Préliminaires

ATTENTION

Ne raccordez pas le TCS à un secteur de plus de 132 V lorsque le sélecteur est sur 110, ou plus de 264 V pour la position 220 V.

1. Avant de raccorder l'écran tactile au réseau électrique (Fig. 1), positionnez le sélecteur de tension secteur sur la valeur correcte. Sur 110, les limites de la tension d'alimentation sont 90 et 132 V. Sur 220, elles sont 180 et 264 V. Le sélecteur se trouve sur la face arrière, utilisez un tournevis pour le faire tourner.

2. Raccorder le cordon d'alimentation à l'appareil d'une part et à une prise secteur d'autre part.

Préchauffage

1. L'interrupteur de mise en marche est situé à l'arrière de l'écran tactile, placez le sur 1 (MARCHE). Un ''beep'' sonore indique alors que l'appareil est en fonctionnement. Ne touchez pas l'écran pendant le préchauffage (Voir Fig. 1).

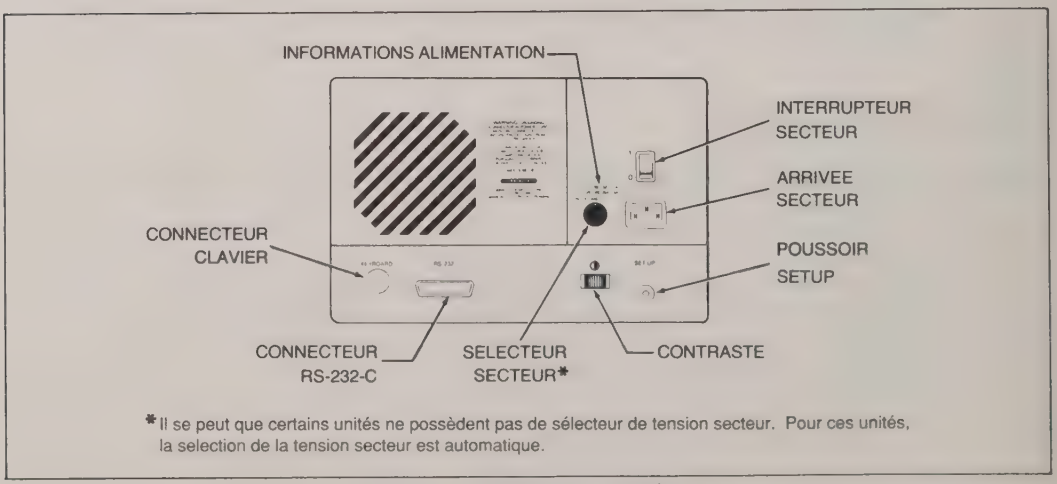
2. Attendez 10 secondes et l'écran affichera le message ''Self-test OK.''

PRECAUTION

Si aucune image n'apparaît ou s'il s'agit d'un message différent contactez un centre technique FLUKE. Sachez que toucher l'écran après 5 secondes fait disparaître le message. Si vous n'avez pas eu le temps de le lire, mettez l'interrupteur sur 0 (ARRET) puis revenez sur 1 (MARCHE).

Pendant les 5 premières minutes, la trame peut rester visible. Ce phénomène commun à tous les tubes cathodiques n'est pas un défaut.

3. Ajustez la commande de contraste (face arrière) pour obtenir une bonne image (Voir Fig. 1).



*Il se peut que certains unités ne possèdent pas de sélecteur de tension secteur. Pour ces unités, la selection de la tension secteur est automatique.

Figure 1. Détail de la face arrière

4. Appuyez sur le poussoir SET UP (face arrière). Cela fait apparaître sur l'écran un menu permettant de régler les paramètres de fonctionnement et d'effectuer les réglages (Fig. 2).

Pour toucher l'écran

L'écran tactile a été conçu, comme son nom l'indique, pour être sensible à une pression légère d'un doigt humain. Bien que sa surface active soit solide, résistante aux rayures et destinée à fonctionner pendant de nombreuses années, il vaut mieux éviter l'emploi d'objets durs ou pointus.

Pour éviter de toucher un autre endroit que celui désiré, le regard doit être exactement en face de celui-ci. Toute vision angulaire amène des erreurs de parallaxe et de ce fait des visées fausses (Fig. 3)

Vérification d'alignement

Avant le départ de l'usine, l'image du TCS a été correctement réglée pour que sa géométrie soit bonne. Toutefois, des différences locales concernant les champs électromagnétiques peuvent nécessiter un réalignement. Dans ce cas, suivez la procédure ci-dessous après avoir placé l'appareil à hauteur de votre regard pour en viser le centre.

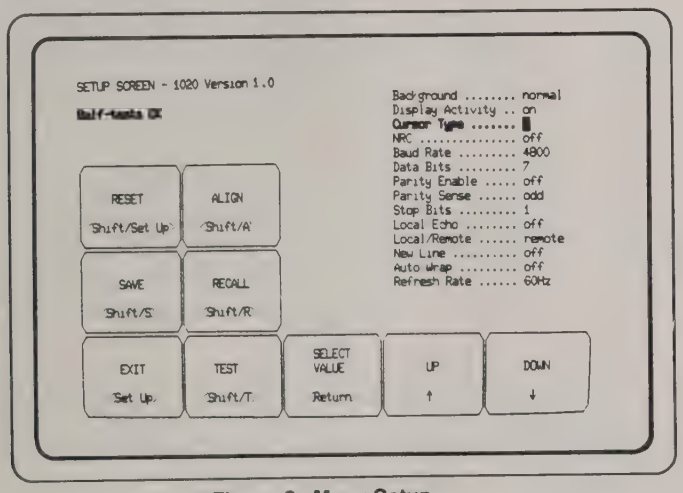


Figure 2. Menu Setup

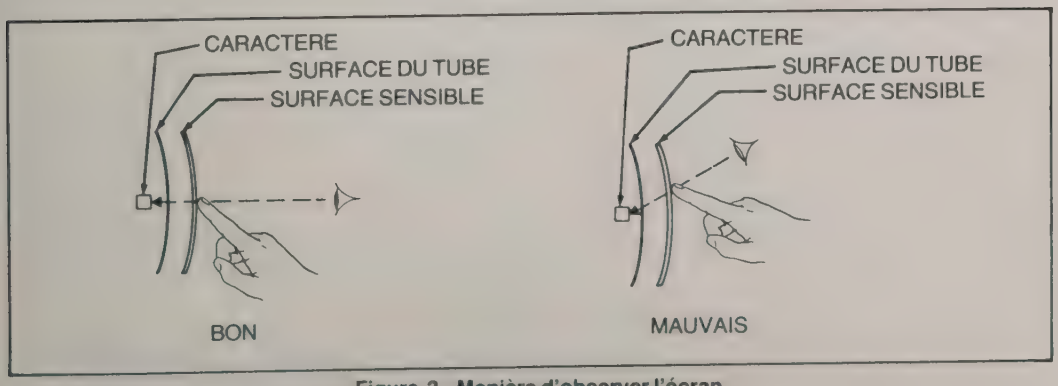


Figure 3. Manière d'observer l'écran

1. Appuyez sur le carré contenant l'inscription ALIGN, une nouvelle image s'inscrit: 2 lignes droites en croix et des touches (4 zones carrées sensibles), pour déplacer la croix (Fig. 4).
2. Localisez les 4 repères de réglage situés sur le chanfrein de l'encadrement de l'écran (Fig. 5).
3. Appuyez sur les touches LEFT (gauche) ou RIGHT (droite) pour déplacer horizontalement la croix et faire coïncider la ligne verticale avec les repères verticaux (On peut utiliser une règle souple).
4. A l'aide des touches UP (haut) ou DOWN (bas) amenez la ligne horizontale exactement en face des repères horizontaux.
5. Appuyez sur la touche EXIT pour revenit à l'image du menu des paramètres.
6. Appuyez sur la touche SAVE pour conserver ce nouvel alignement.

Séquence de test

1. Appuyez sur la touche intitulée TEST pour appeler l'image du menu correspondant (Fig. 2).

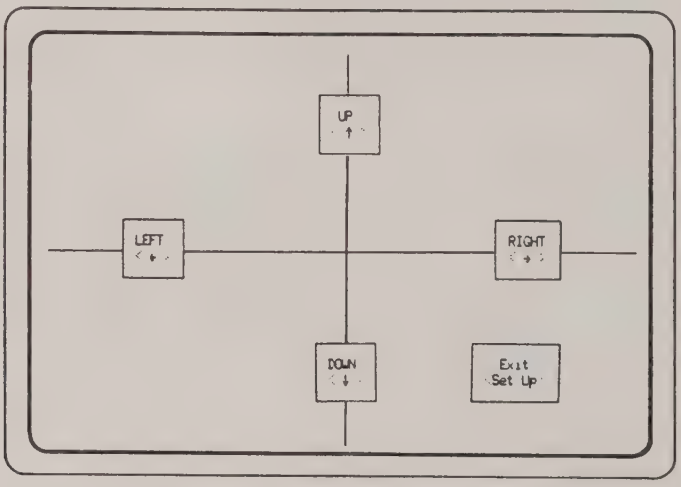


Figure 4. Image pour l'alignement

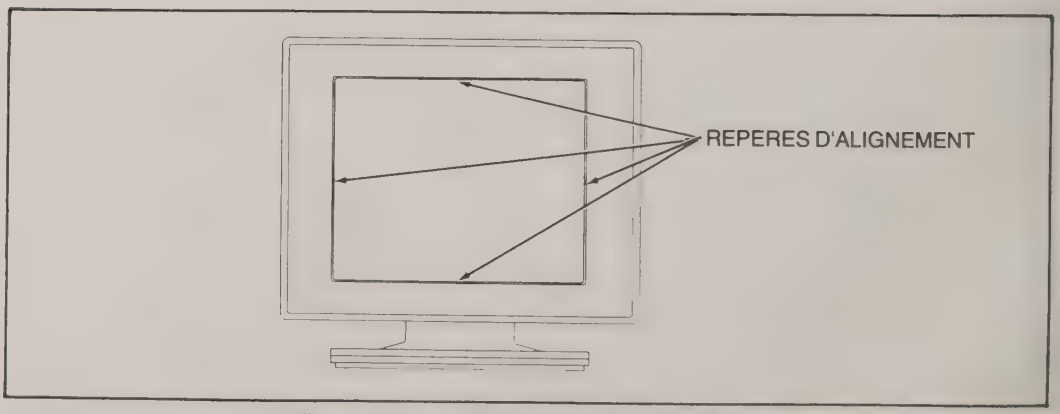


Figure 5. Repère d'alignement sur le chanfrein

2. Appuyez à présent sur la touche TOUCH PANEL et les 120 touches de l'écran tactile apparaissent.

3. Chaque touche est délimitée individuellement et contient un nombre à 3 chiffres. Lorsqu'on appuie sur l'une d'elle, elle passe de vidéo normale à vidéo inverse, ou vice versa.

   Appuyez sur toutes les touches pour en vérifier le bon fonctionnement. En cas de défaut, consultez votre centre technique FLUKE.

4. Appuyez sur le poussoir SET UP, en face arrière, pour revenir au menu des tests.

5. Appuyez sur la touche EXIT pour ramer le menu des paramètres sur l'écran.

6. Appuyez sur la touche EXIT de ce menu pour passer en fonctionnement normal.

Test du clavier optionnel

1. L'écran étant sur arrêt, branchez le clavier optionnel au connecteur correspondant puis remettez l'écran sur marche.

2. A partir du mode normal de fonctionnement, appuyez sur le poussoir SET UP, en face arrière, pour appeler le menu des paramètres et réglages.

3. Appuyez sur la touche TEST pour faire apparaître le menu des tests (Fig. 2).

4. Appuyez sur la touche KEYBOARD.

5. Sur le clavier, appuyez sur chacune des touches, excepté celle indiquant SET UP (extrémité droite de la première rangée). A chaque pression, l'image correspondante à la touche change de vidéo normale à vidéo inverse et vice versa.

NOTE

En cas de défaut, consultez votre centre technique FLUKE.

6. Enfin, appuyez sur la touche clavier SET UP pour ramener le menu des tests.

7. Appuyez à nouveau sur clavier SET UP pour revenir au menu des paramètres.

8. Appuyez une troisième fois sur clavier SET UP pour repasser en fonctionnement normal.

L'opérateur peut sélectionner d'autres tests à partir du menu des paramètres. Reportez vous pour cela au guide de l'utilisateur.

INSTALLATION

Montage sur support

Pour monter le TCS sur un support différent de celui proposé en option par FLUKE, utilisez les 4 points de fixation du dessous de l'appareil.

Ces 4 trous sont filetés au pas de 6–32. Les vis doivent être légèrement plus longues que l'épaisseur du support et, si le boîtier en plastique optionnel du TCS est présent, leur longueur doit dépasser le support de 1,6 à 1,85 mm.

Montage tableau

1. Glissez le TCS dans l'ouverture découpée dans le panneau (Fig. 6).

2. Fixez un écrou-pince en haut du TCS et deux en bas (Fig. 7).

3. Serrez les vis dans les écrous jusqu'à ce que le châssis soit bien contre le panneau (un couple de 13,6 N-m ou 10 ft-lbs, doit suffire).

Si un joint d'étanchéité NEMA est installé, suivre les instructions accompagnant le kit NEMA 12.

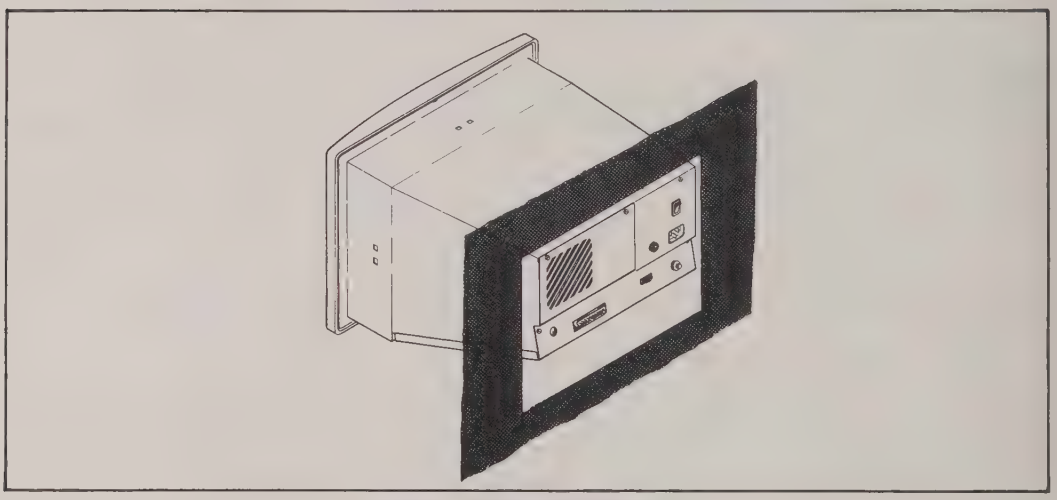


Figure 6. Montage en tableau

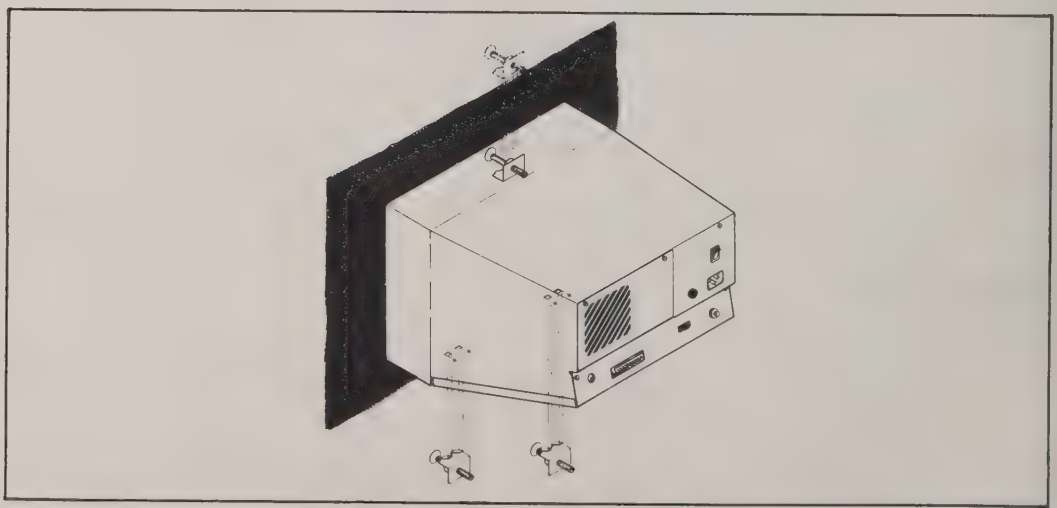


Figure 7. Installation des vis de fixation

POUR COMMENCER AVEC L'ECRAN TACTILE

Connecter le TCS à un ordinateur

Il s'agit d'une liaison série conforme à la norme RS 232 C. Repérez le port de l'interface sur l'appareil hôte.

Mais avant d'installer un câble de liaison, déterminez si cet appareil est un équipement terminal de données (DTE) ou de communication de données (DCE). DTE est habituellement un ordinateur et DCE un modem.

NOTE

S'il s'agit d'un DTE, utilisez un câble dit "null-modem." Pour DCE, employez un câble RS 232 C (Voir Fig. 8 et Fig. 9). Les fils repérés par un astérisque sont ceux correspants une configuration minimum à 3 fils.

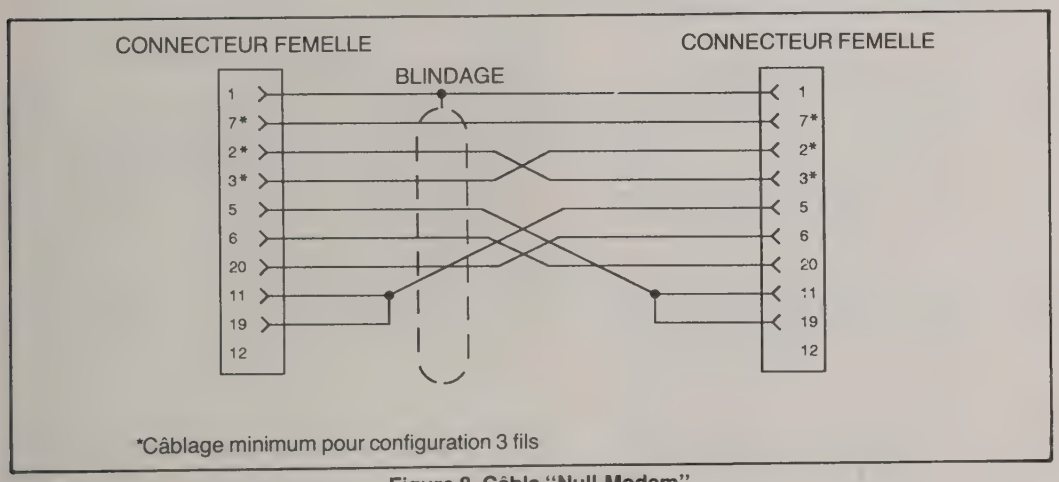


Figure 8. Câble "Null-Modem"

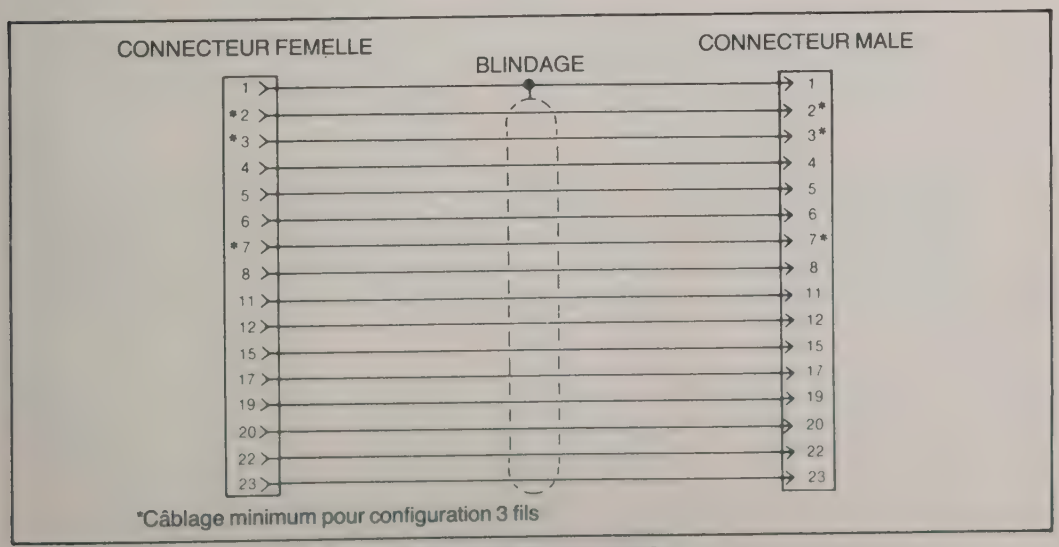


Figure 9. Câble RS-232-C

Les paramètres de communication

1. Appelez l'image du menu des paramètres en appuyant sur le poussoir SET UP.

2. A l'aide des touches UP (haut), DOWN (bas) et SELECT, choisissez les paramètres de communication correspondant à ceux du calculateur hôte.
   Par exemple, le TCS devra être configuré comme suit pour pouvoir exécuter l'échantillon de programme étudié plus loin dans ce guide:

Display Activity	on
Baud Rate	9600 baud (vitesse)
Parity Enable	off (sans bit de parité)
Data Bits	8 (bits de données)
Stop Bits	1 (bits d'arrêt)
Local/Remote	remote

3. Sortir du menu des paramètres en utilisant la touche EXIT ou le poussoir SET UP.

Déroulement d'un programme

L'échantillon de programme du paragraphe suivant montre la manière d'envoyer des caractères et des instructions à l'écran tactile et comment recevoir les commandes des touches de l'écran. Ce programme écrit en BASIC, est utilisable à la fois par un IBM-PC*, un contrôleur d'instruments FLUKE 1722A et un système d'acquisition FLUKE 1752A. Pour être employé par d'autres calculateurs, il suffira en général de changer la façon d'ouvrir les voies de communication.

La communication s'effectue par l'envoi de chaînes de caractères entre le TCS et le calculateur. Pour afficher un message, des caractères alphanumériques ordinaires sont envoyés au TCS. Pour lui envoyer une commande, une chaîne spéciale est nécessaire. Elle commence par un caractère ESCAPE (le nombre décimal 27 dans l'échantillon ci-après).

Les commandes provenant des touches de l'écran emploient des chaînes similaires commençant par un caractère ESCAPE. Ces caractères ESC permettent de différencier les commandes des messages à afficher.

NOTE

Si vous ne parvenez pas à faire exécuter ce programme, vérifiez d'abord qu'il a été correctement entré. Contrôlez ensuite la similarité des paramètres de communication du TCS et du calculateur. Enfin, assurez-vous que le câble et les connexions sont correctes.

Si vous avez besoin d'une aide plus importante, consultez les trois autres guides traitant du TCS: Designer's Guide pour les questions de câblage; Programmer's Guide pour l'étude des protocoles de communication; User's Guide pour la sélection des paramètres de communication. Si votre ordinateur n'accepte pas le langage BASIC, commencez par lire le Programmer's Guide. Il vous permettra de vous familiariser avec la programmation du TCS.

Programme pour IBM-PC

Assurez-vous que la liaison RS 232 C se fait sur le port COM 1. Entrez le BASIC puis le programme suivant:

1. Ouvrir une voie vers le TCS et établir les paramètres de communication:

```
20  OPEN "COM1:9600,N,8,1,CS,DS,CD" AS #1          'Ouvre canal
```


* IBM PC est une marque déposée par International Business Machines, Inc.

2. Ajouter un retour chariot (décimal 13 en ASCII) aux chaînes de caractères envoyés par le TCS:

```
30  PRINT #1,CHR$(27);"[;;13w";      'Ajoute ⟨CR⟩ aux renvois
```

3. Recevoir une commande de touche du TCS:

```
40  INPUT #1,IN$                     'Entre les caractères envoyés par le TCS
50  K$=MID$(IN$,6,3)                 'Extrait le numéro de la touche
```

4. Afficher le numéro de la touche sur le TCS:

```
60  PRINT #1, CHR$(27);"[12;32H";    'Déplace le curseur à la ligne 12,
65                                   'colonne 32.
70  PRINT #1,"YOU TOUCHED: ";K$;     'Envoie le numéro de la touche au TCS
80  GOTO 40                          'Boucle pour la touche suivante
90  END
```

A présent, lancez le programme et appuyez sur l'écran du TCS. A chaque pression, le numéro de la touche sera affiché.

Programme pour FLUKE 1722A et 1752A

Avant d'entrer le BASIC, vérifiez que la liaison RS 232 C est sur le port KB1. Utilisez le programme d'établissement des utilitaires (Set Utility Program) pour configurer les paramètres de communication suivants:

BR (baud rate)	9600
DB (data bits)	8
PB (parity bits)	N
SB (stop bits)	1
EOL (end of line)	13
SO (stall output)	E
SI (stall input)	E

Entrer le BASIC puis le programme ci-dessous:

1. Ouvrir une voie vers le TCS:

```
10  OPEN "KB1:" AS NEW FILE 1        !Etablit une sortie vers le TCS
20  OPEN "KB1:" AS OLD FILE 2        !Etablit une entrée pour le TCS
```

2. Ajouter un retour chariot (13 en ASCII) aux chaînes de caractères envoyées au calculateur:

```
30  PRINT #1,CHR$(27);"[;;13w";      !Ajoute ⟨CR⟩ aux renvois
```

3. Accepter une commande de touche du TCS:

```
40  INPUT #2,IN $                    !Entre les caractères envoyés par le TCS
50  K$=MID(IN$,6,3)                  !Extrait le numéro de la touche
```

4. Afficher le numéro de la touche sur le TCS:

```
60  PRINT #1, CHR$(27);"[12;32H";   !Déplace le curseur à la ligne 12,
65                                   !colonne 32
70  PRINT #1,"YOU TOUCHED: ";K$;     !Envoie le numéro de la touche au TCS
80  GOTO 40                          !Boucle pour la touche suivante
90  END
```

A présent, lancez le programme et appuyez sur l'écran du TCS. A chaque pression, le numéro de la touche s'affichera.

AUTRES GUIDES D'UTILISATION DU TCS

Il existe trois autres manuels traitant de l'écran tactile série 1020:

- User's Guide:
  Il contient les instructions de base pour utiliser le TCS. Il doit être lu en premier par tous les utilisateurs.

- Programmer's Guide:
  Il traite de la communication série et informe complètement sur la façon de programmer le TCS. Son chapitre 9 contient un programme détaillé illustrant les communications entre un TCS et son ordinateur.

- Designer's Guide:
  Il est destiné aux ingénieurs se préparant à incorporer le TCS dans leur système. Ils y trouveront les informations mécaniques et électriques dont ils ont besoin, ainsi que les spécifications et des instructions de montage détaillées.

Tableau 1. Specifications de l'écran tactile — Serie 1020

ENVIRONNEMENT

Température

En service	0 à 50°C sans le boîtier plastique 0 à 60°C sans le boîtier mais avec ventilateur 0 à 40°C avec le boîtier 0 à 50°C avec boîtier et ventilateur
Stockage	–40 à 75°C

Humidité relative

0 à 30°C	95% (sans condensation)
30 à 40°C	75% (sans condensation)
40 à 55°C	45% (sans condensation)
55 à 75°C	40% (sans condensation)

Altitude

En service	3.050 mètres
Stockage	12.000 mètres

Alimentation

NOTE

Cet appareil suit les prescriptions de sécurité Classe 1 du Comité Electrotechnique International. Le fil de terre doit être raccordé.

Tension	90 à 132 V ac, 47 à 440 Hz 180 à 264 V ac, 47 à 440 Hz
Courant dans la masse	moins de 0,5 mA de 47 à 63 Hz moins de 3,5 mA de 63 à 440 Hz
Consommation	moins de 50 watts moins de 1 A de 90 à 132 V moins de 0,5 A de 180 à 264 V

Vibrations ..... satisfait à la norme MIL-T-28800C, Classe 3

FREQUENCE	FORCE	DOUBLE AMPLITUDE
5–15 Hz	0,7 G à 15 Hz	1,52 mm
15–25 Hz	1,3 G à 25 Hz	1,02 mm
25–55 Hz	3 G à 55 Hz	0,51 mm

Chocs ..... demi-sinusoïdal de 30 G pendant 11 ms ± 1 ms.

Etanchéité à la poussière et au ruissellement ..... Conforme à une utilisation en boîtier NEMA type 12 avec option kit de montage sur panneau NEMA 12

ENCOMBREMENT

Dimensions .....
largeur 335,3 mm
hauteur 260,9 mm
profondeur 318 mm sans boîtier
330 mm avec boîtier, sans câbles

Tableau 1. Specifications de l'écran tactile — Serie 1020

Profondeur de montage	300 mm depuis l'arrière de l'encadrement au dos du TCS sans les câbles; 381 mm avec les câbles FLUKE
Masse	8,44 kg sans le boîtier
boîtier	1,59 kg
support	0,68 kg
Montage en tableau	3 points de fixation prévus
Montage en rack	largeur 19″ (482,6 mm) hauteur 6″ (265,9 mm)
Support articulé	mobilité vers l'avant 5 degrés mobilité vers l'arrière 15 degrés
ECRAN TACTILE	
Type	matrice de contacts sous membranes
Nombre de touches	12 rangées, 10 colonnes
Taille d'une touche	correspond à 2 lignes et huit colonnes de caractères simple taille
Solidité	surface dure résistante aux rayures
Transparence	plus de 60%
Caractéristiques optiques	anti-reflets, standard
TUBE CATHODIQUE	
Ecran	12″ (305mm) en diagonale
Couche	monochrome, phosphore P31 (vert) en standard monochrome, phosphore PC194 (ambré) en option.
CARACTERISTIQUES DE L'ECRAN	
Méthode de balayage	trame simple non entrelacée
Fréquence image	50 ou 60 Hz, programmable, choix stocké en mémoire non volatile
Surface active	203 mm de large sur 137 mm de haut
Nombre de caractères	24 lignes de 80 catactères
Nombre de points par caractères	largeur 8 points, hauteur 10 points
Attributs de ligne	normal, double largeur, double taille
Attributs de caractères	normal, surbrillant, souligné, clignotant, vidéo inverse.
Jeu de caractères	256 caractères différents, y compris ceux du code ASCII
Caractères internationaux	par code de remplacement national
Positionnement de l'image	programmable, stockable en mémoire non volatile. Déplacement horizontal: 12 caractères par pas de 1 caractère. Déplacement vertical: 2,4 caractères par pas de 0,1 caractères.
Géométrie de l'image	correction d'une ligne horizontale limitée à 2,54 mm et 1,25 mm pour une verticale.
BEEP SONORE	
Fréquence	2,1 kHz
Sonorité	2 niveaux, sélectables par commutateur

Tableau 1. Specifications de l'écran tactile — Serie 1020

CLAVIER (optionnel)

Longeur	470,2 mm
Largeur	211,5 mm
Hauteur totale	50,8 mm capuchons compris
Masse	1,59 Kg

NORMES

L'écran tactile satisfait aux normes de sécurité suivantes:

ANSI/UL	478	Norme pour les appareils et les systèmes électroniques de traitement de données.
CEI	348	Prescriptions de sécurité pour les appareils électroniques de mesure.
CEI	435	Sécurité des équipements de traitement de données.
CSA	556B	Conditions pour la certification des instruments électroniques et des appareils scientifiques.

L'écran tactile a été vérifié pour satisfaire aux normes d'interférences électromagnétiques suivantes:

FCC	Part 15, subpart J	Composants de calcul (classe B)
VDE	0871	Suppression des interférences provoquées par les appareils de radiofréquence dans l'industrie, dans les laboratoires scientifiques et médicaux et dans les domaines d'emploi similaire (classe B)

検査および据付け用ガイド

はじめに

このガイドは1020シリーズのタッチ・コントロール・スクリーン（ＴＣＳ）の受入検査および据付けについて説明しています。そのほか，ＴＣＳのディスプレイ上にアクティブなタッチキーを作成する簡単なサンプル・プログラムを示します。ＴＣＳの仕様についてはこのガイドの最後を参照してください。

開　梱

注

ＴＣＳ本体または輸送用カートンへの損傷を避けるために，５個以上積み重ねないでください

開梱し，梱包材料をチェックして輸送中にＴＣＳが損傷を受けた可能性がないかどうか検査してください。検査および損害賠償請求についてのインストラクションがこの資料の表紙の裏に記載されています。損傷している可能性が検査によって判明した場合は，ただちに輸送業者に連絡してください。

後日，ＴＣＳをふたたび輸送する必要が生じた場合，元の梱包用カートンを使い，詰め物をすべて所定の状態にして収めてください。元の梱包用カートンが利用できない場合は，新しいカートンと梱包材料をフルークから購入することができます。元の梱包用カートン以外でＴＣＳを輸送しないでください。

TCSの検査

動作切換スイッチの確認

TCS本体の底にある長方形の開口部より動作切換スイッチを切替える事が出来ます。開口部の周囲に貼ってあるレベルには、８通りのスイッチの各機能とそれに対応した現在の各スイッチの位置が表示されます。通常の状態では全てのスイッチは ON(closed) になっており、レベルには何も記載されていません。TCSが工場より通常の規格以外で出荷された場合、レベルは各スイッチの位置を表示しています。その場合、TCSが希望の動作形態になっているか、レベルの表示とスイッチの位置を一致させて確認して下さい。又、動作形態を変更する時は、その都度レベルの表示も変更して下さい。

使用前の準備

注意

電源電圧選択スイッチが110の位置にある時にある時に132 Vacより高い電源電圧でＴＣＳの電源を投入した場合、電源に損傷を与えます。

1. ＴＣＳが設置場所の電源電圧に正しく設定されていることを確認してください。電源電圧選択スイッチは裏面パネル（図１）にあります。110の位置では，ＴＣＳは90Vac～132Vacの電源電圧で動作します。220の位置では180Ｖ～264 Vacの間で動作します。

注

ＴＳＣの電源が正しく設定されていなかった場合，選択スイッチをドライバーで回し，正しい位置に設定してください。

2. 電源コードを本体に接続し，つづいてac コンセントに接続してください。

ウォームアップ・シーケンス

1. ＴＣＳの電源スイッチを１(ON)にセットしてください(図１参照)。ウォームアップ・シーケンスの間はＴＣＳスクリーンに触れないでください。

   装置の電源が投入され，動作していることを示すブザー音が聞こえます。

2. ディスプレイがウォームアップするまで10秒間待ってください。画面に次のメッセージが表示されます。
   Self－tests OK

注

動作して最初の５分間，ラスターがディスプレー上に現れることがあります。これはＣＲＴディスプレイにノーマルな現象で，故障ではありません。

3. 裏面パネルのコンテスト調整スイッチ（図１）を調整し最適の状態にしてください。

注

何も表示されないか，あるいは“Self－tests OK”以外のメッセージが現れた場合は，最寄りのフルークのサービスセンターに連絡してください。５秒後にディスプレイに触れるとメッセージが消えます。メッセージを読む前に消えた場合は，電源スイッチをいったん０（OFF）にセットしてから１(ON）に戻してください。

4. 裏面パネル（図１）のSET UP スイッチを押してください。これによってセットアップ画面が表示されます（図２）。

タッチ・パネルへの接触

タッチ・パネルは指で軽く押すことによって動作するように設計されています。タッチ・パネルは長年の使用に耐えるよう丈夫で傷の付きにくい表面になっていますが，固いとがったもので触れることはお止めください。

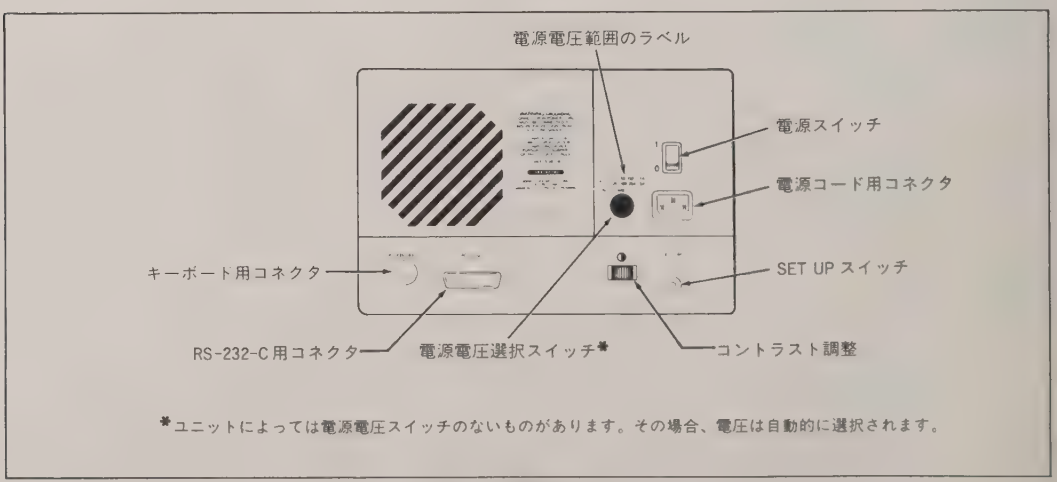


図１．裏面パネル

画面に触れる時，表示されている文字の真正面の位置から見てください（図3参照)。文字の上部，下部，あるいは側方から見ると目的の位置以外の場所に触れる可能性があります。

位置合せの確認

ＴＣＳのディスプレイは工場でタッチ・パネルと正しく位置合せされています。しかし据付け場所での電磁界の変動があるので，位置合せをやり直さなければならないことがあります。位置合せを正しく確認するために，目を画面の高さに置いて画面の中心を真正面から見て次の手続きを実行してください。

1. セットアップ画面の ALIGN にタッチし，アラインメント画面を表示させてください。（図4参照）

2. ＴＣＳの前面枠（図5参照）の中の4つのアラインメント・マークを確認してください。

3. 画面上の LEFT または RIGHT のタッチキーを押して，垂直の細い線が枠の上下にあるアラインメント・マークに合うようにしてください。(フレキシブルな直線定規を上,下枠のアラインメント・マークの間に置いて行なっても良い。)

4. 画面上の UP または DOWN のタッチキーを押して,水平の細い線が枠の左右にあるアラインメント・マークに合うようにしてください。

5. アラインメント画面上の EXIT に触れてふたたびセットアップ画面に戻ってください。

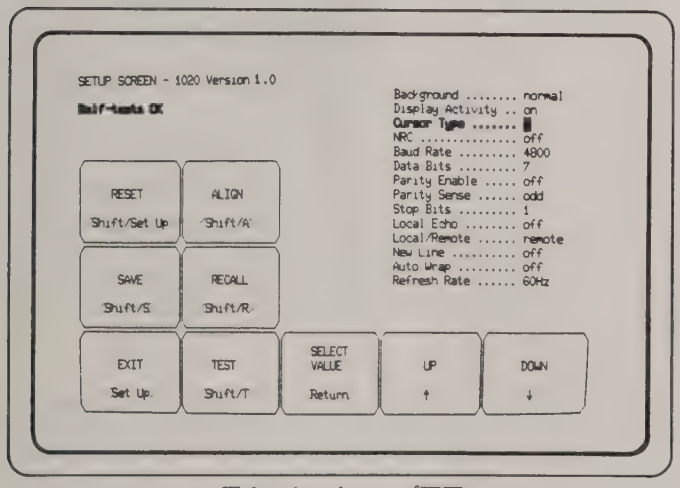


図２．セットアップ画面

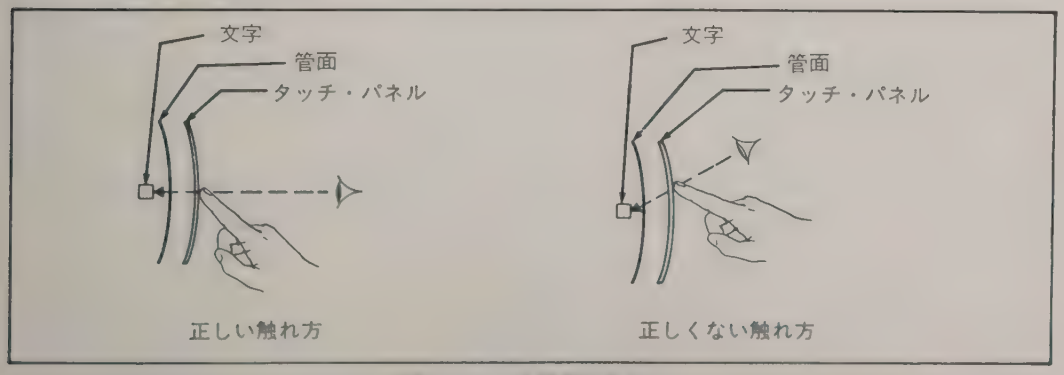


図３．ＴＣＳ画面の見方

6. セットアップ画面上のSAVEに触れて，ディスプレイの新しい位置設定をメモリに記憶させてください。

テスト・シーケンス

1. TESTというラベルのタッチキーを押してテスト画面を選んでください（図2参照）。

2. TOUCH PANELというラベルのタッチキーを押してください。ディスプレイはタッチ・パネル・テスト画面に変ります。

3. 各タッチキーは3桁のタッチ・セル番号によって示される小さなボックスとして表示されます。ボックスに触れるとそのボックスは正常表示と反転表示の間で交互に切り換わります。

上から下へそして左から右へと順番にすべてのタッチキーを押し，タッチ・パネル全体が正常に動作していることを確認してください。

注

触らないのにボックスがアクティブになったり，あるいは何も応答しない場合は，最寄りのフルークのサービス・センターに連絡してください。

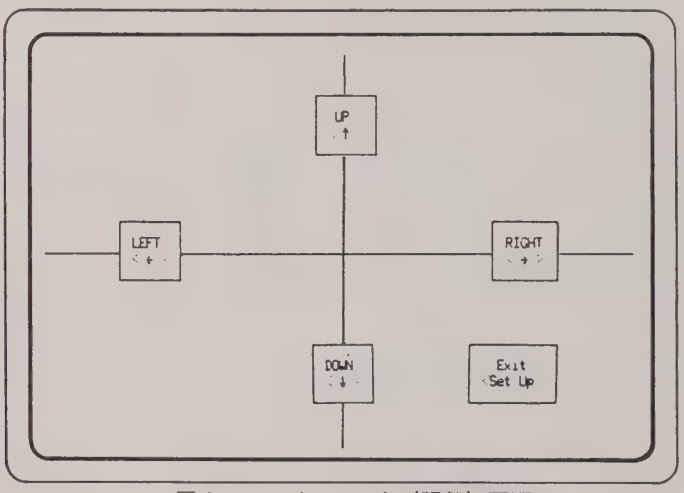


図4．アラインメント（調整）画面

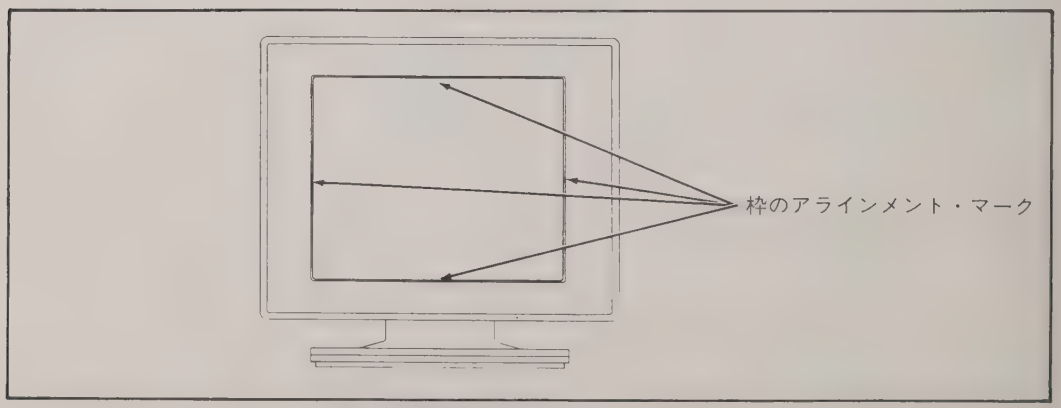


図5．前面枠のアラインメント・マーク

4. 裏面パネルのSET UPスイッチを押してタッチ・パネルのテストから脱出し，テスト画面に戻ってください。

5. EXITタッチキーを押してセットアップ画面に戻ってください。

6. EXITタッチキーを押して，通常の動作モードに戻ってください。

オプションのキーボード・テスト

1. ＴＣＳの電源をオフにして，オプションのキーボードをキーボード・コネクターに挿入し，電源をオンにしてください（図1参照）。

2. 裏面パネルのSET UPスイッチを押してセットアップ画面を選んでください。

3. TESTのタッチキーを押してテスト画面を選んでください（図2参照）。

4. KEYBOARDタッチキーを押してください。

5. SET UPキー以外のキーボード上の各キーを押してください。各キーが押されるたびに，それに対応する画面上の像が正常表示と反転表示の間で切り換わります。

注

触らないのにボックスがアクティブになったり，あるいは何も応答しない場合は，最寄りのフルークのサービスセンターに連絡してください。

6. キーボード上のSET UPキーを押してテストの画面に戻ってください。

7. SET UPキーを再度押してセットアップ画面に戻ってください。

8. SET UPキーを再度押して通常の動作モードに戻ってください。

テスト画面を使って，その他のユーザー選択可能なテストを実行することができます。これらのテストについての詳細はユーザーズ・ガイドを参照してください。

据付け

平面上のマウント

オプションのフルーク傾斜／回転ベース以外のベースにこの装置をマウントするには，装置の底面にある4個の金属の取付部を使用してください。これらの取付部には6-23の機械ねじを用います。オプションのプラスチック・ケースが使われている場合は，ねじの長さはベースの厚さプラス最大1.85㎜（0.73インチ），最低1.6㎜（0.63インチ）を加えた値に等しくなければなりません。

パネル・マウント

ＴＣＳをパネルに取り付けるには次の手続きに従ってください。耐水および耐塵のNEMAガスケットが使われている場合はNEMA 12パネル・マウンティング・キットに付属している説明書を参照してください。

1. 図6に示すようにＴＣＳをパネル・カットアウトの中に挿入してください。（パネル・カットアウトについての詳細はデザイナー・設計者用ガイドを参照してください。）

2. 図7に示すようにＴＣＳのシャーシの上部の1個のクリップおよび底部の2個のクリップを取り付けてください。

3. シャーシがパネルに対してぴったり固定されるまでクリップの中のねじを締めてください（締付けトルクは13.6Ｎ－m，あるいは10 ft－lbsで十分です）。

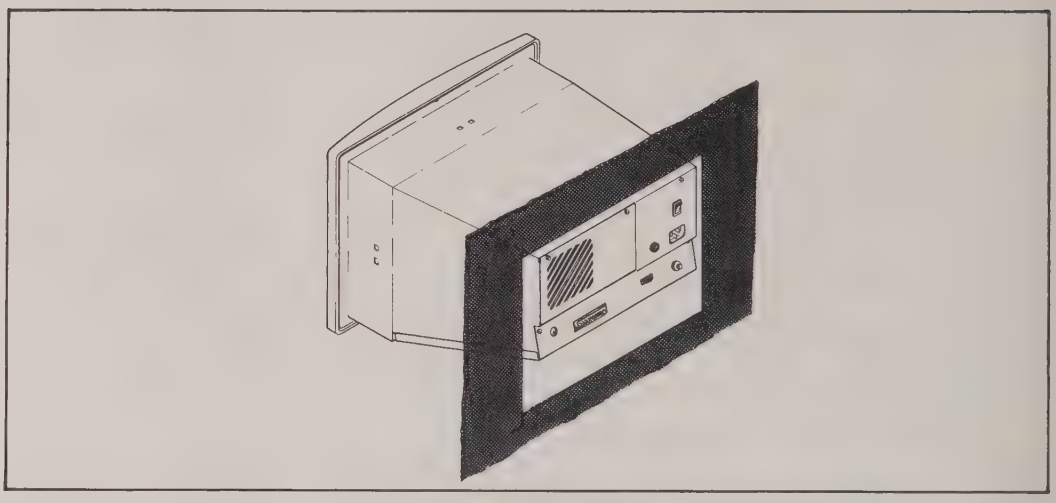


図6．ＴＣＳの取付け

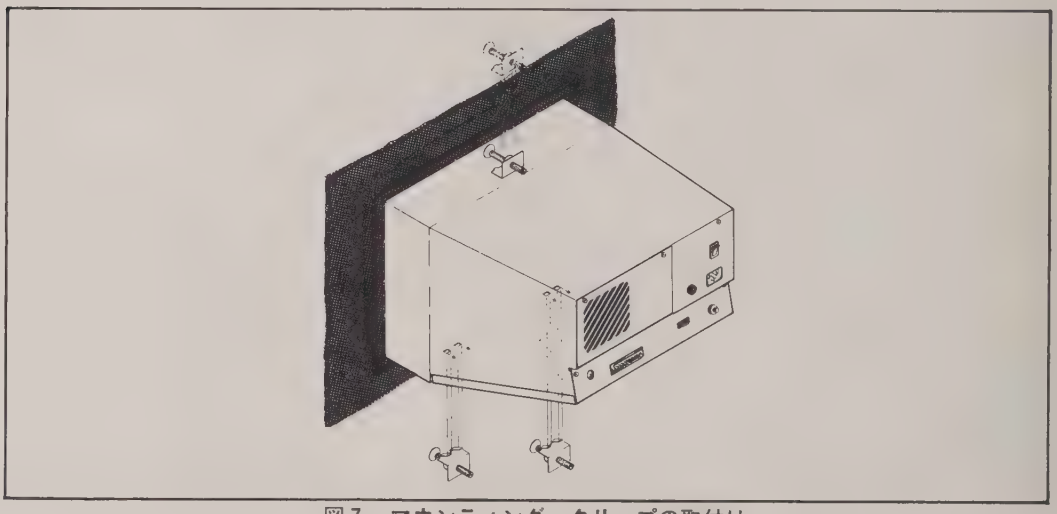


図7．マウンティング・クリップの取付け

タッチ・コントロール・スクリーンの使用準備

TCSをホスト・コンピュータに接続する

ホスト・コンピュータのＲＳ－232－Ｃシリアル・インターフェース・ポートを見付け，ホストがデータ端末装置（ＤＴＥ）またはデータ通信装置（ＤＣＥ）のいずれであるかを確認してください。ＤＴＥは普通はコンピュータであり，ＤＣＥはモデムです。

注

ホストがＤＴＥである場合は，ヌル・モデル・ケーブルをホストとＴＣＳとの間に接続してください。図８に標準のヌル・モデム・ケーブルの配線図を示します。（＊印の付いている線は最小限の３線接続構成に必要な線です。）ホストがＤＣＥの場合はＲＳ－232－Ｃ用ケーブルをモデムとＴＣＳとの間に接続してください。図９に配線図を示します。（＊印の付いている線は最小限の３線接続構成に必要な線です。）

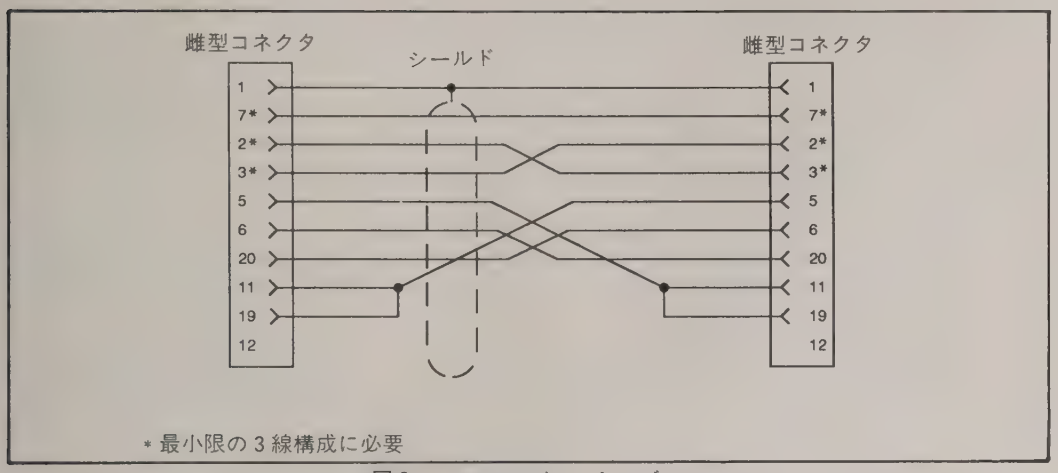


図8．ヌル・モデム・ケーブル

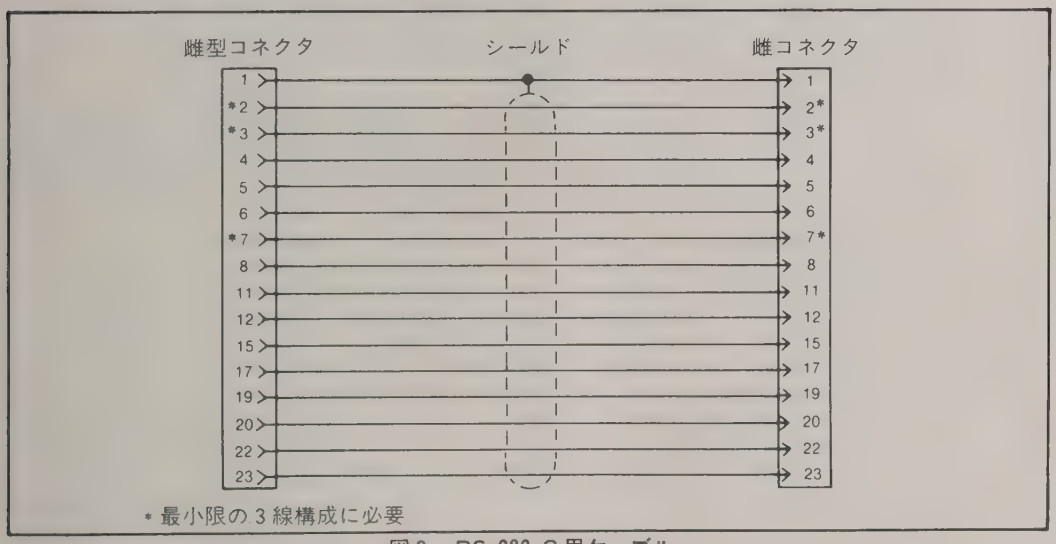


図9．RS-232-C用ケーブル

通信用パラメータの設定

1. TCSの裏面パネルのSET UPスイッチを押してセットアップ画面に入ってください。

2. UP, DOWN, およびSELECTのタッチキーを使って通信用パラメータをホスト・コンピュータのパラメータと合うように設定してください。次のサンプル・プログラムを実行させる前に，TCSの構成が次のようになっていることを確認してください。

ボー・レート	9600
パリティ・イネーブル	オフ
データー・ビット	8
ストップ・ビット	1
動作状況の表示	オン
ローカル／リモート	リモート

3. Exitタッチキーを押すか，あるいはこの装置の裏面にあるSET UPスイッチを押すことによってセットアップ画面から脱出してください。

サンプル・プログラムの実行

次のサンプル・プログラムはホスト・コンピュータからＴＣＳに対して文字およびコマンドを送る方法，また，ＴＣＳからタッチ・レポートを受信する方法を示しています。このプログラムは BASIC プログラム言語で書かれており，IBM PC*, フルーク1722Ａインストルメント・コントローラーあるいはフルーク1752Ａデーター収集システムに対して用意されています。他のホストでこのプログラムを実行させるには，通常は，通信チャンネルをオープンする方法を変えるだけで済みます。

通信はＴＣＳとホストとの間で文字のシーケンスを転送することによって行われます。メッセージを表示するには，通常の英数字がＴＣＳに送られます。ＴＣＳに対してコマンドを送るには，特別のコントロール・シーケンスが使われます。コントロール・シーケンスはエスケープ文字（プログラムの中では十進数27で表されている）で始ります。

ＴＣＳからホストへのタッチ・レポートは同様なコントロール・シーケンスを使い，やはりエスケープ文字で始ります。エスケープ文字はコマンドと，表示されるメッセージを区別するために必要です。

注

何かトラブルがあったり，あるいはタッチ・セルの値がこのプログラム実行後にディスプレイ上に現れない場合は，プログラムが正しく入力されたかどうかチェックしてください次にＴＣＳとホストの通信用パラメータが同じであるかどうかチェックしてください。最後に，ケーブルのタイプおよび接続が正しいかどうかチェックしてください

このほか，必要な場合は，ケーブルに関してはデザイナー・ガイドを，通信用プロトコルの説明に関してはプログラマーズ・ガイドを，そして通信用パラメータを選択するためのセットアップ画面の使い方についての詳細はユーザーズ・ガイドを参照してください。ホスト・コンピュータがBASIC プログラムを実行しない場合はプログラムを実行させようとする前にプログラマーズ・ガイドを読んでＴＣＳのプログラミングについて熟知するようにしてください。

この簡単なプログラムではＩＢＭ PC* とのハンドシェーク用の特殊ケーブルは不要です。他のプログラムでは正しくハンドシェークするために特別のヌル・モデム・ケーブルを必要とする場合があります。図10を参照してください。

IBM PC用プログラム

ＴＣＳがＲＳ―232―Ｃポート COM１に接続されていることを確認してください。（前の接続に関する説明を参照してください。）BASIC に入って次のようにプログラムの行をタイプしてください。

1. ＴＣＳへのチャンネルをオープンし，通信用パラメータを設定する。

```
20  OPEN "COM1:9600,N,8,1,CS,DS,CD" AS #1        'Open channel
```

2. キャリッジ・リターン・コード（ＡＳＣＩＩ文字13）をＴＣＳからの文字列に付加させホストへ送る。

```
30  PRINT #1,CHR$(27);"[;;13w";      'Append 〈CR〉 to reports
```

3. ＴＣＳからタッチ入力を受信する。

```
40  INPUT #1,IN$                     'Input string from TCS
50  K$=MID$(IN$,6,3)                 'Strip out touch cell value
```

4. ＴＣＳのディスプレイ上にタッチ・セルの値をプリントする。

```
60  PRINT #1, CHR$(27);"[12;32H";    'Move cursor to row 12 column 32
70  PRINT #1,"YOU TOUCHED: ";K$;     'Send touch cell value to TCS
80  GOTO 40                          'Get next touch
90  END
```


*IBM はインターナショナル・ビジネス・マシン株式会社のトレードマークです。

ここでプログラムを実行させ，ＴＣＳ上の画面に触れてください。触れるたびに，タッチ・セルの値がディスプレイ上に現れます。

フルーク1722Ａ，1752Ａ用プログラム

BASICに入る前に，ＴＣＳがＲＳ—232—Ｃポート KB1に接続されていることを確認してください。（前の接続についての説明を参照してください。)1722Ａ／1752Ａのユーティリティ設定プログラムを使って次の通り通信用パラメータを構成してください。

ＢＲ（ボー・レート）	9600
ＤＢ（データ・ビット）	8
ＰＢ（パリティ・ビット）	N
ＳＢ（ストップ・ビット）	1
ＥＯＬ（行の終り）	13
ＳＯ（ストール出力）	E
ＳＩ（ストール入力）	E

BASIC に入って次のプログラム行をタイプしてください。

1. ＴＣＳへのチャンネルをオープンする。

```
10  OPEN "KB1:" AS NEW FILE 1      !Open output channel to TCS
20  OPEN "KB1:" AS OLD FILE 2      !Open input channel from TCS
```

2. キャリッジ・リターン・コード（ＡＳＣＩＩ文字13）をＴＣＳからの文字列に付加させホストに送る。

```
30  PRINT #1,CHR$(27);"[;;13w";    !Append 〈CR〉 to reports
```

3. ＴＣＳからタッチ入力を受信する。

```
40  INPUT #2,IN$                   !Input string from TCS
50  K$=MID(IN$,6,3)                !Strip out touch cell value
```

4. ＴＣＳのディスプレイ上にタッチ・セルの値をプリントする。

```
60  PRINT #1, CHR$(27);"[12;32H";  !Move cursor to row 12 column 32
70  PRINT #1,"YOU TOUCHED: ";K$;   !Send touch cell value to TCS
80  GOTO 40                        !Get next touch
90  END
```

プログラムを実行させＴＣＳの画面に触れてください。触れるたびに，タッチ・セルの値がディスプレイ上に現れる筈です。

TCSの使用

ＴＣＳについての詳細は1020シリーズ・マニュアル・セットの中の他のマニュアルを参照してください。他のマニュアルとしては次のものがあります。

- ユーザーズ・ガイド：ＴＣＳの基本的な操作説明が記載されています。ＴＣＳのユーザーはすべてまず最初にこのガイドを読む必要があります。
- プログラマーズ・ガイド：シリアル通信に関する事項およびＴＣＳのプログラム方法について詳しく記載されています。プログラマーズ・ガイドの第９章にはＴＣＳとホスト・コンピュータとの間の通信のためのもう少し複雑な例題プログラムが入っています。
- デザイナー・ガイド：エンジニアおよび設計者がＴＣＳをシステムに組み入れるために必要な機械的，電気的および他の設計事項が記載されています。またこのデザイナー・ガイドにはＴＣＳの仕様および据付けの詳細情報も記載されています。

TCSの仕様

ＴＣＳの仕様を表１に示します。

表1．タッチ・コントロール・スクリーンの仕様

環境条件

温度

動作温度……0～50℃（プラスチック・ケース無しの場合）
0～60℃（プラスチック・ケース無し，オプションのファン付きの場合）
0～40℃（プラスチック・ケース付きの場合）
0～50℃（プラスチック・ケース付き，オプションのファン付きの場合）

非動作状態……－40～75℃

相対温度

0～30℃……95%（結露なし）
30～40℃……75%（結露なし）
40～55℃……45%（結露なし）
55～75℃……40%（結露なし）

高度

動作状態……3050メータ（10,000フィート）
非動作状態……12,000メータ（40,000フィート）

電源

注

この装置はＩＥＣの安全基準クラスＩの製品です。電源コードの接地線は安全のために必ず接続してください。

電圧……90～132Vac，47～440Hz
180～264Vac，47～440Hz

安全接地漏洩電流……0.5mA以下（47～63Hz）
3.5mA以下（63～440Hz）

消費電力……50W以下
1Arms以下（90～132Vac）
0.5Arms以下（180～264Vac）

振動……MIL－T－28800C，クラス3の条件に適合

周波数	荷重	倍振幅
5—15Hz	0.7G at 15Hz	1.52mm(0.06inch)
15—25Hz	1.3G at 25Hz	1.02mm(0.04inch)
25—55Hz	3G at 55Hz	0.51mm(0.02inch)

衝撃……30Gの半正弦波の衝撃を11ms±1msの間加える。

耐塵および耐滴……オプションのNEMA12パネル・マウンティング・キットを用いNEMAタイプ12のケースに入れて使うのに適している。

表1. タッチコントロール・・スクリーンの仕様（その2）

梱包

寸法	幅335.3mm（13.2インチ） 高さ260.9mm（10.27インチ） ケース無しの深さ318mm（12.5インチ） ケース付きの深さ330mm（13.0インチ）
最小の取付け深さ	ケーブル無しでベーゼル(枠)の後面からＴＣＳの後まで300mm（11.8インチ）フルークのケーブル付きの場合381mm（15.0インチ）
重量	プラスチック・ケース無しの場合8.44kg（18.6ポンド）
ケース	1.59kg（3.5ポンド）
傾斜/回転台	0.68kg（1.5ポンド）
パネル・マウント	3点のマウンティング・クリップ付き
ラック・マウント(オプション)	幅482.6mm（19.0インチ） 高さ265.9mm（10.5インチ），ラック高6単位
傾斜/回転台(オプション)	前方傾斜5度まで 後方傾斜15度まで

タッチ・パネル

タイプ	薄膜スイッチ・マトリックス
タッチ・セルの数	12行，10列，アクティブ・ディスプレイの端から端まで
タッチ・セルのサイズ	標準文字サイズの2行，8列分
耐損傷性	硬質の傷の付きにくい表面
光の透過性	60%以上
光学特性	アンチグレア標準装備

CRT

管サイズ	対角線の長さ305mm（12インチ）
管タイプ	モノクロームP31燐(緑)標準，モノクロームPC194燐(アンバー）オプション

ディスプレイの特性

走査方法	順次走査
リフレッシュ	50／60Hz，プログラマブル，不揮発性メモリに記憶
アクティブ・ディスプレイ・サイズ	幅203mm（8インチ），高さ137mm（5.4インチ）
画面上の文字セル	24行×80字
文字セル当りのドット数	幅8ドット，高さ10ドット
行の文字表示型式	ノーマル，倍幅，倍サイズ
文字表示型式	ノーマル，高輝度，アンダーライン，点滅，反転表示
文字セットのサイズ	256文字（ＡＳＣＩＩ文字を含む）
国際文字	National Replacement Code（ＮＲＣ）使用
ディスプレイの位置合せ	プログラマブル；不揮発性メモリに記憶 水平調整範囲；12字，分解能1字。 垂直の調整範囲；2.4字，(走査線24本)，0.1字（走査線1本）の分解能
ディスプレイの寸法	水平線は2.54mm（0.1インチ）の幅内に適合 垂直線は1.25mm（0.05インチ）の幅内に適合

表1．タッチ・コントロール・スクリーンの仕様（その3）

ブザー

周波数……2.1KHz
音量……2レベルおよびオフ・スイッチ選択可能

キーボード（オプション）

長さ……470.2㎜（18.51インチ）
幅……211.5㎜（8.33インチ）
全体の最大高……キーキャップを含めて50.8㎜（2.0インチ）
重量……1.59㎏（3.5ポンド）

安全規準

このタッチ・コントロール・スクリーンは次の安全規準に適合するように設計されています。

ANSI／UL	478	電子データ処理装置およびシステムのための規準
IEC	348	電子測定装置に対する安全条件
IEC	435	データ処理装置の安全性
CSA	556B	電子計測器および科学装置に対する認証条件

ＴＣＳは次のＥＭＩ（電磁妨害）規準に適合することが確認されています。

FCC	パート15，サブパートＪのコンピューティング・デバイス（クラスＢ）	
VDE	0871	産業，科学，医学，および類似の目的の高周波装置の電波障害の抑制（クラスＢ）

Alabama

Huntsville
4920 Corporate Drive
Suite J
Huntsville, AL 35805-6202
(205) 837-0581

Arizona

Tempe
2211 S. 48th Street
Suite B
Tempe, AZ 85282
(602) 438-8314

Tucson
(602) 790-9881

California

Northern
46610 Landing Parkway
Fremont, CA 94538
(415) 651-5112

Irvine
P.O. Box 19676
Irvine, CA 92713-9676
16969 Von Karman
Suite 100
Irvine, CA 92714
(714) 863-9031

Burbank
(213) 849-7181

Los Angeles
(213) 747-5935

San Diego
(619) 292-7657

Colorado

Denver
14180 E. Evans Ave.
Aurora, CO 80014
(303) 695-1000

Connecticut

Hartford
Glen Lochen East
41-C New London Turnpike
Glastonbury, CT 06033
(203) 659-3541

Florida

Clearwater
(813) 799-0087

Miami
(305) 462-1380

Orlando
940 N. Fern Creek Ave.
Orlando, FL 32803
(407) 896-4881

Tampa
(813) 251-9211

Georgia

Atlanta
2700 Delk Road
Suite 150
Marietta, GA 30067
(404) 953-4747

Illinois

Chicago
1150 W. Euclid Avenue
Palatine, IL 60067
(312) 705-0500

Indiana

Indianapolis
8777 Purdue Road
Suite 101
Indianapolis, IN 46268
(317) 875-7870

Louisiana

New Orleans
(504) 455-0814

Massachusetts

Boston
Middlesex Technology Center
900 Middlesex Turnpike
Building 8
Billerica, MA 01821
(508) 663-2400

Maryland

Baltimore
(301) 792-7060

Rockville
5640 Fishers Lane
Rockville, MD 20852
(301) 770-1570

Michigan

Detroit
45550 Helm Street
Metro West Industrial Park
Plymouth, MI 48170
(313) 522-9140

Minnesota

Eagen
1380 Corporate Center Curve
Suite 113
Eagan, MN 55121
(612) 854-5526

Missouri

St. Louis
11756 Borman Drive
Suite 160
St. Louis, MO 63146
(314) 993-3805

North Carolina

Greensboro
1310 Beaman Place
Greensboro, NC 27408
(919) 273-1918

New Jersey

Paramus
P.O. Box 930
Paramus, NJ 07653-0930
West 75 Century Road
Paramus, NJ 07652
(201) 262-9550

New Mexico

Albuquerque
(505) 881-3550

New York

Rochester
4515 Culver Road
Rochester, NY 14622
(716) 323-1400

Ohio

Cleveland
Plaza South Three
Suite 402
7271 Engle Road
Middleburg Heights, OH 44130
(216) 234-4540

Oklahoma

Northeast
(405) 236-2977

Tulsa
(918) 665-3530

Oregon

Portland
(503) 227-2042

Pennsylvania

Malvern
200 Lindenwood Drive
Malvern, PA 19355
(215) 647-9550

Pittsburgh
(412) 261-5171

Texas

Austin
(512) 459-3344

Dallas
1801 Royal Lane
Suite 307
Dallas, TX 75229
(214) 869-0311

El Paso
(915) 533-3508

Houston
(713) 240-5995

San Antonio
10417 Gulfdale
San Antonio, TX 78216
(512) 340-0498

Utah

Salt Lake City
(801) 268-9331

Washington

Seattle
5020 148th Ave. N.E.
Suite 110
Redmond, WA 98052
(206) 881-6966

Washington, DC

Washington, DC
(301) 770-1570

Algeria
Bureau de Liaison Philips
24 rue Bougainville
El Mouradis, Alger
Tel: 60 14 05
TLX: 62221

Argentina
Coasin S.A.
Virrey del Pino 4071DPTO E-65
1430 CAP FED
Buenos Aires, Argentina
Tel: (54) (1) 552-5248
TLX: (390) 22284

Australia
Philips Scientific & Industrial Pty Ltd.
Centrecourt 25-27 Paul Street
North Ryde
Sydney N.S.W. 2113
Tel: (61) 88 88 222
FAX: (61) 2-888-0440

Austria
Osterreichische Philips Industrie GmbH
Geschaftsbereich I & E
Marktbereich Test-und MeBgerate
A-1101 WIEN, Triester StraBe 64
Tel: (0222) 60101/1722 DW

Bangladesh
Motherland Corporation
24 Hatkhola Road, Tikatuli
Dacca-3, Bangledesh
Tel: 257249
TLX: (950) 642022

Belgium
N.V. Philips Professional Systems S.A.
Test and Measurement
Tweestationsstraat 80
Rue des Deux Gares
Brussel 1070 Bruxelles
Tel: 2-5256111

Bolivia
Coasin Bolivia S.R.L.
Casilla 7295
La Paz, Bolivia
Tel: (591) (2) 40962
TLX: (336) 3233 COALAP BV

Brazil
ATP Hi-Tek Eletronica Ltda.
Al. Amazonas 422, Alphaville
Barueri 06400
Sao Paulo, Brazil
Tel: (55) (11) 421-5477
TLX: (391) 1171413

Brunei
Rank O'Connor's, Sdn Bhd
No. 8 Block D
Sufri Shophouse Complex
Mile 1 Jalan Tutong
Bandar Seri Begawan
Negara Brunei Darussalam
Tel: (673) (2) 23109 or 23557
TLX: (799) BU2265 RANKOC

Canada
Fluke Electronics Canada Inc.
400 Britannia Rd. East Unit #1
Mississauga, Ontario
L4Z 1X9 Canada
Tel: (416) 890-7600
FAX: (416) 890-6866

Fluke Electronics Canada Inc.
1690 Woodward Drive, Suite 216
Ottawa, Ontario
K2C 3R8 Canada
Tel: (613) 723-9453
FAX: (613) 723-9458

Fluke Electronics Canada Inc.
1255 Trans Canada Highway
Suite 130
Dorval, Quebec
H9P 2V4 Canada
Tel: (514) 685-0022
FAX: (514) 685-0039

Fluke Electronics Canada Inc.
101, 1144 - 29th Ave. N.E.
Calgary, Alberta
T2E 7P1 Canada
Tel: (403) 291-5215
FAX: (403) 291 5219

Chile
Intronica Chile, Ltda.
Casilla 16228
Santiago 9, Chile
Tel: (56) 2-2321886
TLX: (332) 346351

China, Peoples Republic of
Fluke Asia Ltd.
Shun Tak Centre, Suite No. 1501
200 Connaught Road
Central, Hong Kong
Tel: (852) 5-482116
TLX: (780) 87058 Fluke
FAX: (852) 5-479863

Colombia
Sistemas E Instrumentation, Ltda.
Carrera 21, No. 39A - 21, Of. 101
Ap. Aereo 29583, Bogota, Colombia
Tel: (57) 232-4532
TLX: (396) 45787

Denmark
Philips A/S Test & Measurement
Prags Boulevard 80
DK-2300-Kobenhavn S
Tel: (01) 572222
TLX: 31201

Ecuador
Proteco Coasin Cia., Ltda.
P.O. Box 228-A
Ave. 12 de Octubre 2285 y Orellana
Quito, Ecuador
Tel: (593) (2) 529684
TLX: (393) 22085

Proteco Coasin Cia., Ltda.
P.O. Box 9733
Ave. Principal No. 204 y Calle Segunda
Urbanizacion Miraflores
Guayaquil, Ecuador
Tel: (593) (4) 387519

Egypt
Philips Egypt Liaison Office of Philips Export B.V.
10, Abdel Rahman el Rafei Str.
P.O. Box 1687
Dokki, Cairo
Tel: 20-2-3490922
TLX: 228 16 PHEGY UN

Ethiopia
Philips Ethiopia (Priv. Ltd. Co.)
Ras Abebe Areguay Avenue
P.O. Box 2565, Addis Ababa
Tel: 148300

Fiji
Awa New Zealand Ltd.
37 Freestone Walu Bay Road
P.O. Box 858, Suva, Fiji
Tel: (679) 312079
TLX: (792) 2347
FAX: (679) 314379

Finland
Instrumentarium Elektronikka
P.O. Box 64
02631 Espoo 63, Finland
Tel: (358) (0) 5281
TLX: (857) 124426
FAX: (358) 0-502-1073

France
S.A. Philips Industrielle et Commercials
Division Science de Industrie
105 rue de Paris, BP 62
93002 BOBIGNY Cedex
Tel: (1) 49 42 80 80
TLX: 210290

Germany
Philips GmbH
Unternehmensbereich
Elektronik fur Wissenschaft
und Industria
Vertriebsbereich Testr & MeBtechnik
MiramstraBe 87 Postfach 310320
D-3500 KASSEL
Tel: (0561) 5010
TLX: 997070

Bereich Fluke Produkts
Oskar-Messter-Strape 18
D-8045 Ismaning

Great Britain
Philips Test & Measurement
Colonial Way
Watford WD2 4TT

Greece
Philips S.A. Hellenique I&E Division
15, 25th March Street
GR-17778 TAVROS or
P.O. Box 3153 Athens
Tel: 30-1-4894911
TLX: 241566-241567

Hong Kong
Schmidt & Co (H.K.), Ltd
18th Floor, Great Eagle Centre
23 Harbour Road
Wanchai, Hong Kong
Tel: (852) (5) 8330-222
TLX: (780) 74766 or 76762
FAX: (852) 5-8918754

India
Hinditron Services Pvt., Ltd.
69/A.L. Jagmohandas Marg
Bombay 400 006, India
Tel: (91) (22) 8121316,
(91) (22) 8125344
TLX: (953) 1175326
FAX: (91) 22-822-0197

Hinditron Services Pvt., Ltd.
8th Main Road
33/44A Raj Mahal Vilas Extension
Bangalore 560 080, India
Tel: (91) 812-363139
TLX: (953) 8452741

Hinditron Services Pvt., Ltd.
5th Floor, "Castle House"
5/1A, Hungerford St.
Calcutta 700 017, India
Tel: (91) 33-432628
TLX: (953) 21-4153

Hinditron Services Pvt., Ltd.
204-5-6 Hemkunt Tower
98 Nehru Place
New Delhi, 110019, India
Tel: (91) 11-6410380
TLX: (953) 316458

Hinditron Services Pvt., Ltd.
Emerald Complex 1-7-264 5th Floor
114 Sarojini Devi Rd.
Secunderabad 500 003, India
Tel: (91) 842 821117
TLX: (953) 04256973

Indonesia
P.T. Lamda Triguna
P.O. Box 6/JATJG, Jakarta 13001
Tel: (62) 21-8195365
TLX: (796) 63938
FAX: (62) 21-819-9631

Iran
Philips Iran Ltd.
(Private Joint Stock Comp.)
P.O. Box 11365-3891, Tehran
Tel: 98-21-674138
TLX:212545PHPS IR

Iraq
Philips Medden Oosten B.V.
Baghdad Branch
Hai Al Whida. Area No. 902
Street No. 12, Bldg. 141/10
P.O. Box 5749, Baghdad
Tel: 7187181
TLX: 212439 Philips IK

Ireland
P.J. Brennan and Company Ltd.
61 Stillorgan Industrial Park
Stillorgan, Co. Dublin
Tel: 952501
TLX: 3817
FAX: 952333

Israel
R.D.T. Electronics Engineering Ltd.
P.O. Box 43137
Tel Aviv 61430 Israel
Tel: (972) (3) 483211
TLX: 371452
FAX: 972-3-492190

Italy
Philips S.p.A.
Sezione S & I, T & M Dept.
Viale Elvezia 2, 20052 Monza
[illegible]: (039) 3635240/8/9
[illegible]X: 333343

Japan
John Fluke Mfg. Co., Inc.
Japan Branch
Sumitomo Higashi Shinbashi Bldg.
1-1-11 Hamamatsucho
Minato-ku, Tokyo 105, Japan
Tel: (81) (3) 434-0188
TLX: (781) 2424331
FAX: 81-3-434-0170

John Fluke Mfg. Co., Inc.
Japan Branch
Katsushige Building
2-45 Kohraibashi
Higashi-ku, Osaka 541, Japan
Tel: (81) (6) 229-0871
FAX: 81-6-229-1098

Kenya
Philips (Kenya) Ltd.
OL Kalou Road, Industrial Area
P.O. Box 30554, Nairobi
Tel: 254-2-557999
TLX: 22225 Nairobi

Korea, Republic of
Myoung Corporation
Yeo Eui Do
P.O. Box 14, Seoul, Korea
Tel: (82) (2) 784-9942
TLX: (787) MYOUNG K24283
FAX: (82) 2-784-2387

[illegible]uwait
[illegible] Bahar International Group
P.O. Box 26672 Safat
13127 Safat, Kuwait
Tel: (965) 848601
TLX: (959) 44822

Lebanon
Philips Middle East S.A.R.L.
B.P. 11-670
Ave. Sami Solh, Beyrouth
Tel: 392320/1
TLX: 20765 LE PHIBAN

Malaysia
Mecomb Malaysia Sdn Bhd
P.O. Box 24
46700 Petaling Jaya
Selangor, Malaysia
Tel: (60) 3-7743422
TLX: (784) MA37764
FAX: (60) 3-774 3414

Mexico
Mexicana de Electronica Industrial S.A. (MEXEL)
Diagonal No. 27
Entre Calle de Eugenia Y Ave.
Colonia del Valle, C.P. 03100, Mexico
Tel: (905) 660-4323
TLX: (383) 1771038
FAX: 525-687-8695

Morocco
Somaciel
304 Boulevard Mohamed V,
Casablanca 05
Tel: 30 80 51/52
TLX: 27021

Nepal
Associated Enterprises
GPO Box 790, Pyaphal Tole
Kathmandu, Nepal
Tel: 13868
TLX: (947) 2568

Netherlands
Philips Nederland
Philips I&E Systems Div.
Building TQIII-4
5600 MD Eindhoven, The Netherlands
Tel: (31) 40-786839
TLX: (844) 35000 PHTC NL
FAX: (31) 40-785968

New Zealand
Philips Scientific & Industrial Pty Ltd.
2 Wagener Place, P.O. Box 4 021
Auckland 3, New Zealand
Tel: (64) (09) 894-160
TLX: NZ 2395
FAX: (64) (9) 862-728

Nigeria
Associated Electronic Products (Nigeria) Ltd.
KM 16, Ikorodu Road, Ojota
P.O. Box 1921,Lagos
Tel: 234-1-900160/69
TLX: 21961 NG

Norway
Morgenstierne & Co A/S
Konghellegate 3
P.O. Box 6688, Rodelokka
Oslo 5, Norway
Tel: (47) (2) 356110
TLX: (856) 71719
FAX: (47) 2-381457

Pakistan
International Operations (PAK Private), Ltd.
505 Muhammadi House
I.I. Chundrigar Road
P.O. Box 5323, Karachi, Pakistan
Tel: (92) (21) 221127
TLX: (952) 24494

Peru
Importaciones y Representaciones Electronicas S.A.
Avda. Franklin D. Roosevelt 105
Lima 1, Peru
Tel: (51) (14) 28-8650
TLX: (394) 25663

Philippines, Republic of
Spark Radio & Electronics, Inc.
Greenhills 1502, P.O. Box 610
San Juan, Metro Manila,
Philippines
Tel: (63) (2) 775192
TLX: (712) 4005

Portugal
Decada Equipamentos de Electronica
Av. Bombeiros Voluntarios
Lote 102B, Miraflores/Alges
1495 Lisbon, Portugal
Tel: (351) (1) 4103420
TLX: (832) 15515
FAX: (351) 1-410-1844

Singapore, Republic of
Rank O'Connor's PTE Ltd.
O'Connor House
98 Pasir Panjang Road
Singapore 0511
Republic of Singapore
Tel: (65) 4737944
TLX: (786) RS21023

South Africa
South African Philips (Pty) Ltd.
P.O.B. 7703
10 Bond Street, Randburg 2194
Johannesburg 2000
Tel: (27) (011) 889-3911

Spain
Philips Iberica S.A.E. Dpto
Aparatos de Medida
Martinez Villergas 2, Madrid 28027
Tel: 404-2200

Sri Lanka
Computerlink Data Systems, Ltd.
331 Union Place
Colombo, 2, Sri Lanka
Tel: (94) (1) 28641/2
TLX: (954) 22455

Sweden
Philips Foersaeljning AB
Division Industrielektronik
Test & Measurement
S-115 84 Stockholm
Tel: (08) 782 18 00

Switzerland
Philips AG Test-und Messtechnik
Postfach, CH-8027 Zurich
Tel: (01) 4882390

Syria
Philips Moyen-Orient S.A.R.L.
Rue Fardoss 79, P.O. Box 2442
Damascus
Tel: 218605/221650
TLX: PHISYR 411203 SY

Taiwan
Schmidt Electronics Corp.
5th Floor, Cathay Min-Sheng
Commercial Building,
344 Min-Sheng East Road
Taipei 104, Taiwan R.O.C.
Tel: (886) (2) 501-3468
TLX: (785) 11111
FAX: (886) 2-5029692

Tanzania
Philips (Tanzania) Ltd.
T.D.F.L. Building - 1st Floor
P.O. Box 20104
Ohio/Upanga Rd.
Dar es Salaam
Tel: 29571/4
TLX: 41016

Thailand
Measuretronix Ltd.
2102/63 Ramkamhaeng Road
Bangkok 10240, Thailand
Tel: (66) (2) 374-2516
TLX: (788) 82796
FAX: (66) 2-374-9965

Tunisia
STIET
32bis rue Ben Ghedahem, Tunis
Tel: 348666
TLX: (934) 13030

Turkey
Turk Philips Ticaret A.S.
Inonu Caddesi 78/80, P.K. 504
80074 Beyoglu-Istanbul
Tel: 90-1-1435910
TLX: 24192 PHTRTR

United Arab Emirates
Philips Middle East
Dubai International Trade Centre
11th Floor
P.O. Box 9269, Dubai
Tel: 971-4-377000
TLX: 46350 PMOA EM

Uruguay
Coasin Uruguaya S.A.
Libertad 2529
Casilla de Correo 1400
Montevideo, Uruguay
Tel: (598) (2) 789015
TLX: (398) UY23010

Venezuela
Coasin C.A.
Calle 9 Con Calle 4, Edif Edinurbi
Apartado de Correos NR-70.136
Los Ruices
Caracas 1070-A, Venezuela
Tel: (58) 2-241-0309
TLX: (395) 21027

Zaire
Philips Electronics S.A.R.L.
137, Boulevard du 30 juin
B.P. 16636, Kinshasa
Tel: 31693
TLX: 21078 KINSHASA

Zambia
Philips Electrical Zambia Ltd.
Mwembeshi Road
P.O. Box 1878, Lusaka
Tel: 218511/218701
TLX: Za 41220

Zimbabwe
Philips Electrical (Pvt.) Ltd.
62 Mutare Road
P.O. Box 994, Harare
Tel: 47211/48031
TLX: 2236

For other countries not listed above:
Fluke Int'l Corp
P.O. Box C9090
Mail Stop 206A
Everett, WA 98206
Tel: 206-356-5511
TLX: 185103 FLUKE UT
FAX: (206) 356-5116

U.S. Service Locations

California
Fluke Technical Center
16969 Von Karman Avenue
Suite 100
Irvine, CA 92714
Tel: (714) 863-9031

Fluke Technical Center
46610 Landing Parkway
Fremont, CA 94538
Tel: (415) 651-5112

Colorado
Fluke Technical Center
14180 East Evans Avenue
Aurora, CO 80014
Tel: (303) 695-1171

Florida
Fluke Technical Center
940 N. Fern Creek Avenue
Orlando, FL 32803
Tel: (407) 896-4881

Illinois
Fluke Technical Center
1150 W. Euclid Ave.
Palatine, IL 60067
Tel: (312) 705-0500

Maryland
Fluke Technical Center
5640 Fishers Lane
Rockville, MD 20852
Tel: (301) 770-1576

New Jersey
Fluke Technical Center
East 66 Midland Avenue
Paramus, NJ 07652-0930
Tel: (201) 599-9500

Texas
Fluke Technical Center
1801 Royal Lane, Suite 307
Dallas, TX 75229
Tel: (214) 869-2848

Washington
Fluke Technical Center
John Fluke Mfg. Co., Inc.
1420 75th St. S.W.
M/S 6-30
Everett, WA 98203
Tel: (206) 356-5560

International

Argentina
Coasin S.A.
Virrey del Pino 4071 DPTO E-65
1430 CAP FED
Buenos Aires
Tel: 54 1 522-5248

Australia
Philips Customer Support
Scientific and Industrial
23 Lakeside Drive
Tally Ho Technology Park
East Burwood
Victoria 3151

Australia
Philips Customer Support
Scientific & Industrial
25-27 Paul St. North
North Ryde N.S.W. 2113
Tel: 61 02 888 8222

Austria
Oesterreichische Philips Industrie
Unternehmensbereich Prof. Systeme
Triesterstrasse 66
Postfach 217
A-1101 Wein
Tel: 43 222-60101, x1388

Belgium
Philips & MBLE Associated S.A.
Scientific & Industrial Equip. Div
Service Department.
80 Rue des deux Gares B-1070
Brussels
Tel: 32 2 525 6111

Brazil
Hi-Tek Electronica Ltda.
Al. Amazonas 422, Alphaville
CEP 06400 Barueri
Sao Paulo
Tel: 55 11 421-5477

Canada
Fluke Electronics Canada Inc.
400 Britannia Rd. East, Unit #1
Mississauga
Ontario L4Z 1X9
Tel: 416-890-7600

Chile
Intronica Chile Ltda.
Casilla 16228
Santiago 9
Tel: 56 2 2321886, 2324308

China
Fluke International Corp.
P.O. Box 9085
Beijing
Tel: 86 01 512-3436

Colombia
Sistemas E Instrumentacion, Ltda.
Carrera 13, No. 37-43, Of. 401
Ap. Aereo 29583
Bogota DE
Tel: 57 232-4532

Denmark
Philips A/S
Technical Service I & E
Strandlodsveij 1A
PO Box 1919
DK-2300
Copenhagen S
Tel: 45 1 572222

Ecuador
Proteco Coasin Cia., Ltda.
P.O. Box 228-A
Ave. 12 de Octubre
2285 y Orellana
Quito
Tel: 593 2 529684

Egypt
Philips Egypt
10, Abdel Rahman el Rafei st.
el. Mohandessin
P.O. Box 242
Dokki Cairo
Tel: 20-2-490922

England
Philips Scientific
Test & Measuring Division
Colonial Way
Watford
Hertforshire WD2 4TT
Tel: 44 923-40511

Finland
Oy Philips AB
Central Service
Sinikalliontie 1-3
P.O. Box 11
SF-02630 ESPOO
Tel: 358-0-52572

France
S.A. Philips Industrielle
et Comerciale,
Science et Industry
105 Rue de Paris Bp 62
93002 Bobigny, Cedex
Tel: 33-1-4942-8040

Germany (F.R.G.)
Philips GmbH
Service fuer FLUKE - Produkte
Department VSF
Oskar-Messter-Strasse 18
D-8045 Ismaning/Munich,
West Germany
Tel: 49 089 9605-239

Greece
Philips S.A. Hellenique
15, 25th March Street
177 78 Tavros
10210 Athens
Tel: 30 1 4894911

Hong Kong
Schmidt & Co (H.K.) Ltd.
18/FL., Great Eagle Centre
23 Harbour Road
Wanchai
Tel: 852 5 8330222

India
Hinditron Services Pvt. Ltd
1st Floor, 17-B,
Mahal Industrial Estate
Mahakali Road, Andheri East
Bombay 400 093
Tel: 91 22 6300043

Hinditron Services Pvt. Inc.
33/44A Raj Mahal Villas Extn.
8th Main Road
Bangalore 560 080
Tel: 91 812 363139

Hinditron Services Pvt. Ltd.
Field Service Center
Emerald Complex 1-7-264
5th Floor
114 Sarojini Devi Road
Secunderabad 500 003
Tel: 08 42-821117

Hindtron Services Pvt. Ltd.
15 Community Centre
Panchshila Park
New Delhi 110 017
Tel: 011-6433675

Indonesia
P.T. Lamda Triguna
P.O. Box 6/JATJG
Jakarta 13001
Tel: (021) 8195365

Israel
R.D.T. Electronics Engineering, Ltd.
P.O. Box 43137
Tel Aviv 61430
Tel: 972 3 483211

Italy
Philips S.p.A.
Sezione I&E / T&M
Viale Elvezia 2
2005 Monza
Tel: 39 39 3635342

Japan
John Fluke Mfg. Co., Inc.
Japan Branch
Sumitomo Higashi Shinbashi Bldg.
1-1-11 Hamamatsucho
Minato-ku
Tokyo 105
Tel: 81 3 434-0181

Korea
Myoung Corporation
Yeo Eui Do P.O. Box 14
Seoul 150
Tel: 82 2 784-9942

Malaysia
Mecomb Malaysia Sdn. Bhd.
P.O. Box 24
46700 Petaling Jaya
Selangor
Tel: 60 3 774-3422

Mexico
Mexel Servicios en Computacion
Instrumentacion y Perifericos
Blvd. Adolfo Lopez Mateos No. 163
Col. Mixcoac
Mexico D.F.
Tel: 52-5-563-5411

Netherlands
Philips Nederland
Test & Meetapparaten Div.
Postbus 115
5000 AC Tilburg
Tel: 31-13-352445

New Zealand
Philips Customer Support
Scientific & Industrial Division
2 Wagener Place
Mt. Albert
Auckland
Tel: 64 9 894-160

Norway
Morgenstierne & Co. A/S
Konghellegate 3
P.O. Box 6688, Rodelokka
Oslo 5
Tel: 47 2 356110

Pakistan
International Operations (PAK) Ltd.
505 Muhammadi House
I.I. Chundrigar Road
P.O. Box 5323
Karachi
Tel: 92 21 221127, 239052

Peru
Importaciones & Representaciones
Electronicas S.A.
Avad Franklin D. Roosevelt 105
Lima 1
Tel: 51 14 288650

Philippines
Spark Radio & ElectronicS Inc.
Greenhills, P.O. Box 610
San Juan, Metro-Manila Zip 3113
Tel: 63-2-775192

Portugal
Decada Espectral
Equipmentos de Elec. e Cientificos
Av. Bomberios Voluntarios
Lote 102B, Miraflores/Alges
1495 Lisboa
Tel: 351 1 410-3420

Singapore
Rank O'Connor's Singapore (PTE) Ltd.
98 Pasir Panjang Road
Singapore 0511
Tel: 65 4737944

South Africa
South African Philips (Pty) Ltd.
Service Department
195 Main Rd
Martindale, Johannesburg, 2092
Tel: 27 11 470-5255

Spain
Philips Iberica S.A.E.
Depto. Tecnico Instrumentacion
c/Martinez Villergas 2
28027 Madrid
Tel: 34 1 4042200

Sweden
Philips Kistaindustrier AB
Customer Support
Borgarfjordsgatan 16
S-16493 Kista

Switzerland
Philips A.G.
Technischer Kundendienst
Postfach 670
Allmendstrasse 140
CH-8027 Zurich
Tel: 41 1 482211

Taiwan
Schmidt Electronics Corp.
5th Floor, Cathay Min Sheng
Commercial Building,
344 Min Sheng East Road
Taipei
Tel: 886 2501-3468

Thailand
Measuretronix Ltd.
2102/63 Ramkamhaeng Rd.
Bangkok 10240
Tel: 66 2 374-2516, 374-1632

Turkey
Turk Philips Ticaret A.S.
Inonu Caddesi 78/80
Posta Kutusu 504-Beyoglu
Istanbul
Tel: 90 1 1435891

Uruguay
Coasin Uruguaya S.A
Casilla de Correo 1400
Libertad 2525
Montevideo
Tel: 598-2-789015

Venezuela
Coasin C.A.
Calle 9 Con Calle 4, Edif. Edinurbi
Apartado de Correos Nr-70-136
Los Ruices
Caracas 1070-A
Tel: 58 2 241-0309, 241-1248

West Germany
Philips GmbH
Department VSF
Service fuer FLUKE - Produkte
Oskar - Messter - Strasse 18
D-8045 Ismaning / Munich
Tel: 49 089 9605-260

1020 Series

TOUCH CONTROL SCREEN

User's Guide

FLUKE

1020 Series

TOUCH CONTROL SCREEN

User's Guide

P/N 778753
April 1986 Rev. 1, 7/89
©1989 John Fluke Mfg. Co., Inc. All rights reserved. Litho in U.S.A

FLUKE

Table of Contents

TITLE	PAGE
Introduction	1
About the User's Guide	1
Optional Configurations	1
Functional Overview	1
Data Flow from the Touch Control Screen to the Host	3
Data Flow from the Host to the Touch Control Screen	3
Non-Volatile Setup Memory	4
Controls and Indicators	4
Configuration Switch	4
Power Switch	4
Line Voltage Selection Switch	4
Touch Panel	4
Contrast Control	4
SET UP Switch	5
Beeper	5
Optional Keyboard	5
Connecting to the Host	5
Using Modems	6
Direct-Connect	6
Selecting Line Voltage	8
Turning On the TCS	9
Power-Up Sequence	9
ROM Checksum Test	10
RAM Integrity Test	10
Non-Volatile Setup Memory Test	10
Touch Panel Closure Test	10
Touching the Touch Panel	10
Using the Setup Screen	10
Major Divisions of the Setup Screen	11
Parameter List Area	11
Direct Action Area	11
Operational Status Window	13
How to Call Up and Exit the Setup Screen	14
How to Change Setup Parameters	14
How to Save Setup Parameters	15
Volatility of Setup Parameters	15
Descriptions of the Setup Parameters	15
Aligning the Display	22

(continued on page ii)

TITLE	PAGE
Using the Optional Keyboard	24
Standard Keys	25
The Set Up Key	28
Cursor Control Keys	28
Special Function Keys	28
Auxiliary Keypad	29
Caring for the Touch Control Screen	29
Cleaning the Touch Panel	30
Cleaning the Optional Enclosure	30
Cleaning the Optional Keyboard	30
Problems?	30
Testing the Touch Control Screen with the Test Screen	31
Touch Panel Integrity Test	32
Display Geometry Test	32
Display Intensity Test	34
Standard Character Set Test	34
Extended Character Set Test	34
Keyboard Test	35
Raw Keyboard Test	35
Continuous Integrity Test	36
Glossary	37
Index	45

List of Tables

TABLE	TITLE	PAGE
1.	Default Values of Setup Parameters	15
2.	National Replacement Code Characters	17
3.	Touch Control Screen Parity Settings	20
4.	Effects of the New Line Parameter on Characters Sent to the Host	21
5.	Effects of the New Line Parameter on Cursor Movement	22
6.	Non-Alphanumeric Standard Key Codes	25
7.	Characters Sent by Keys Pressed with Ctrl	27
8.	Cursor Control Key Codes	28
9.	Special Function Key Codes	29
10.	Auxiliary Keypad Codes	30

List of Illustrations

FIGURE	TITLE	PAGE
1.	Touch Control Screen with Enclosure and Keyboard	2
2.	Touch Control Screen	2
3.	Functional Block Diagram	3
4.	Rear Panel View	6
5.	Connecting to the Host Using Modems	7
6.	Connecting to the Host Directly	7
7.	Selecting Line Voltage	8
8.	Normal Power-Up Display	9
9.	Avoiding Parallax Error	11
10.	Setup Screen	12
11.	Alignment Screen	23
12.	Bezel Alignment Marks	23
13.	Optional Keyboard	24
14.	Test Screen	31
15.	Touch Panel Integrity Test	33
16.	Display Geometry Test	33
17.	Standard Character Set Test	34
18.	Extended Character Set Test	35
19.	Keyboard Test	36

User's Guide

INTRODUCTION

The Touch Control Screen (TCS) is a sophisticated interface between human operators and computer-driven systems. The TCS allows the operator, with a minimum of training, to accurately and efficiently control even the most complex operations, simply by touching the screen.

The Touch Control Screen interprets character strings from the host computer to create displays that provide the operator with information, or ask the operator to select from the choices presented. The operator responds naturally by pointing to the appropriate choice and touching the display lightly. The TCS, acting as a software configured control panel, tells the computer that a particular area was touched.

ABOUT THE USER'S GUIDE

This User's Guide contains basic instructions for using the Touch Control Screen. The guide describes the features of the TCS, including its touch panel, controls and indicators, and optional keyboard. The guide also provides instructions for turning the TCS on, setting up the TCS with the Setup Screen, aligning the display with the Alignment Screen, and running various functional tests with the Test Screen.

WARNING

ALL SERVICING IS TO BE PERFORMED BY QUALIFIED PERSONNEL ONLY. THERE ARE NO USER-SERVICEABLE PARTS INSIDE THE PRODUCT.

OPTIONAL CONFIGURATIONS

The TCS is available with an optional plastic enclosure and keyboard. Because the built-in touch panel allows user input, not all TCS installations require the keyboard. Figure 1 shows the TCS with the enclosure and the keyboard; Figure 2 shows the TCS without the enclosure.

FUNCTIONAL OVERVIEW

The following paragraphs provide a functional overview of how the TCS relates to the host computer and the user. A functional block diagram of the TCS is shown in Figure 3.

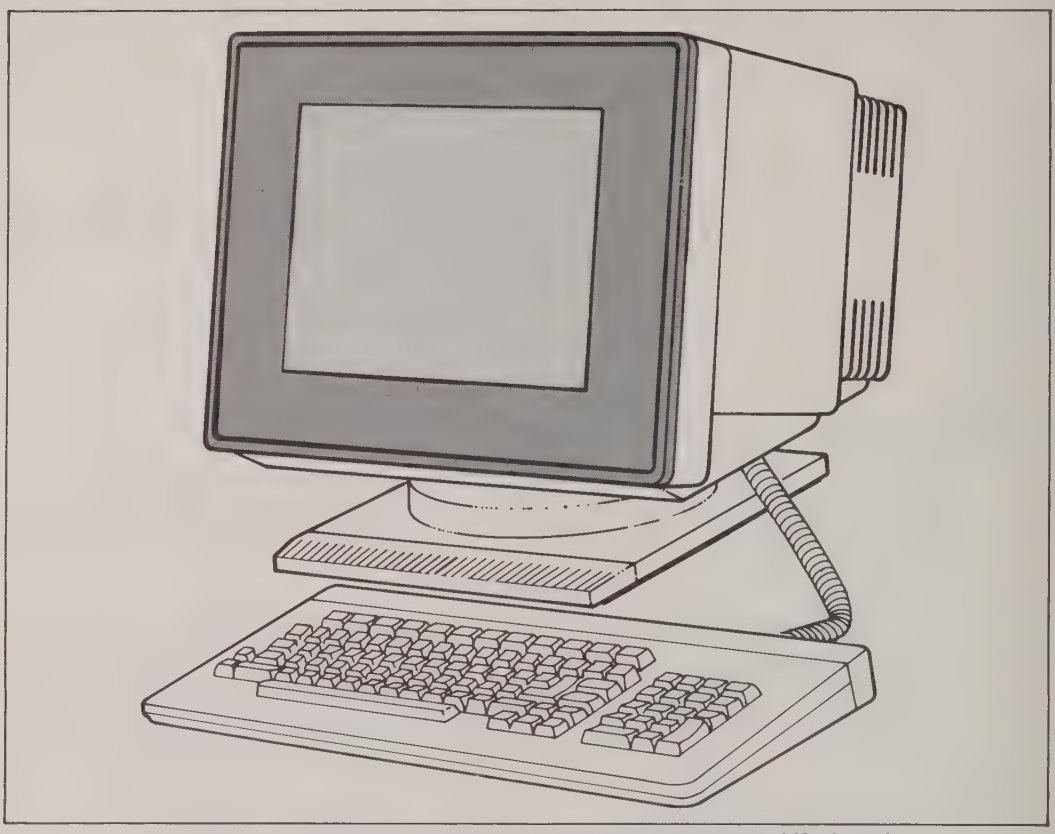


Figure 1. Touch Control Screen with Optional Enclosure and Keyboard

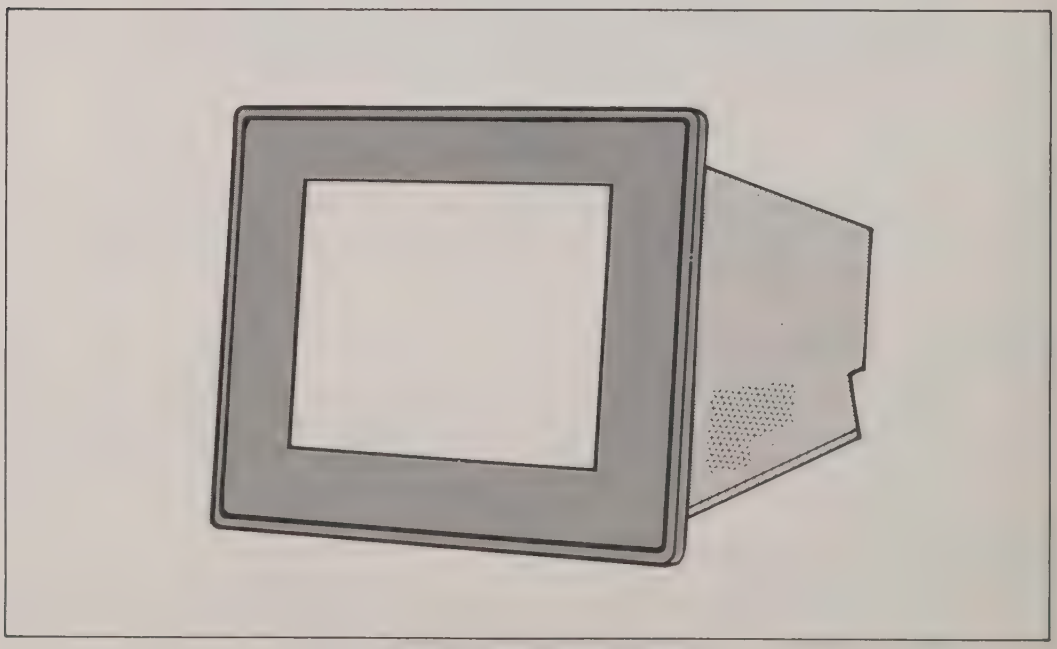


Figure 2. Touch Control Screen

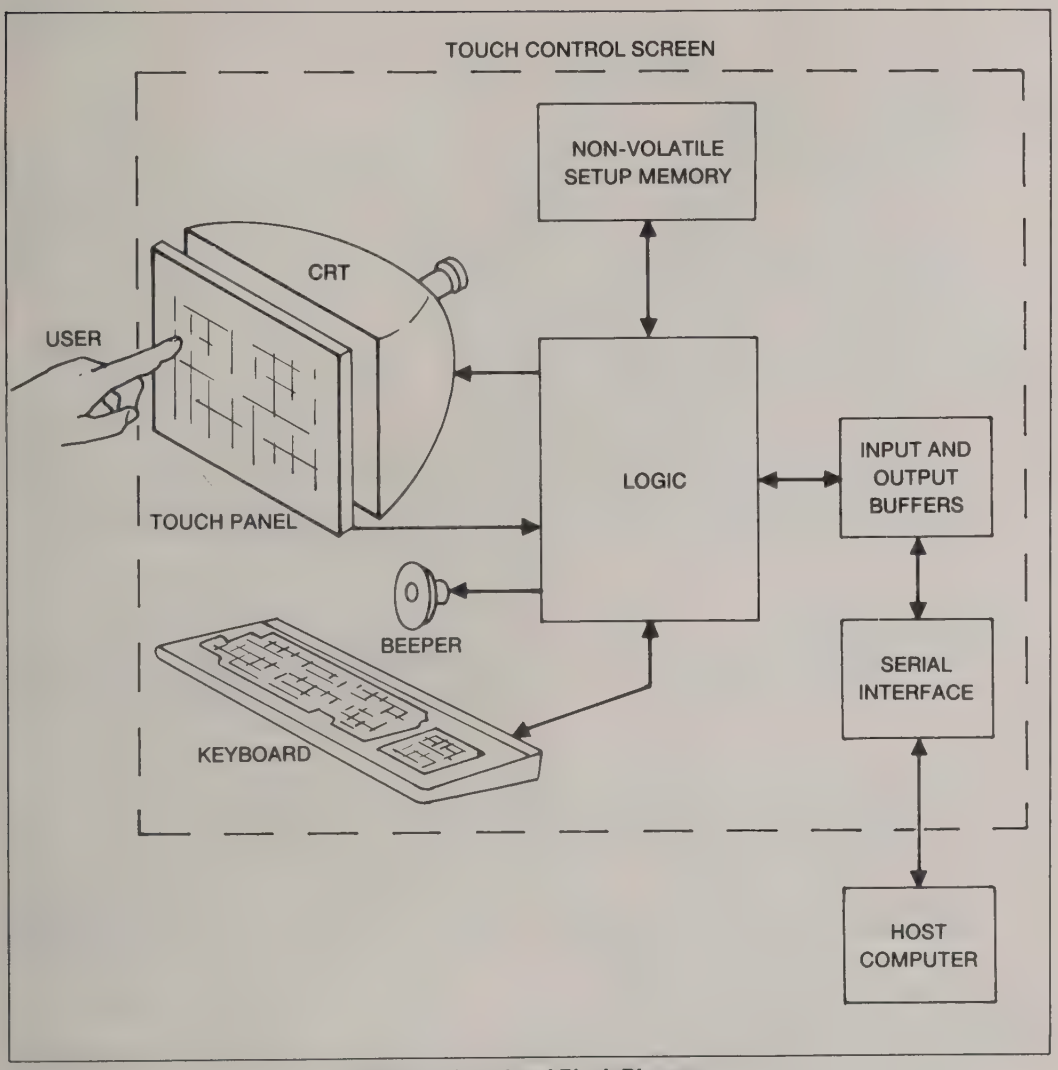


Figure 3. Functional Block Diagram

Data Flow from the Touch Control Screen to the Host

The user sends information to the host computer by pressing touch cells on the surface of the touch panel or by pressing keys on the optional keyboard. Data is transmitted from the TCS through an output buffer. The output buffer can be controlled by the host to prevent the TCS from transmitting characters faster than the host can process them.

Data Flow from the Host to the Touch Control Screen

Data sent from the host computer enters the input buffer where it is stored until the TCS can read it. The TCS processes the data from the input buffer and responds appropriately to commands it encounters in the data stream. Printable characters are displayed on the CRT display. When the input buffer fills, the TCS sends a message to the host to halt transmission. When there is again room in the input buffer, the TCS

signals to the host to resume transmission. This prevents the host from transmitting characters faster than they can be processed.

Non-Volatile Setup Memory

The TCS has a non-volatile Setup memory for storing Setup parameters. This feature allows the user to configure the TCS as desired and store Setup parameters for recall on the next power-up. The TCS keeps the factory-programmed default Setup parameter values in memory. The factory-programmed default values are only recalled on a hard reset, which is a command that can only be sent by the host computer.

CONTROLS AND INDICATORS

Controls on the TCS include the power switch, line power voltage selection switch, touch panel, contrast control, SET UP switch, and the optional keyboard. There are two keycap LED (light-emitting diode) indicators on the keyboard. The display provides visual feedback, and a beeper in the TCS provides audible feedback. The following paragraphs describe these features in detail.

Configuration Switch

This is an eight-segment DIP slide switch located on the bottom panel. It controls the beeper volume and establishes one of the requirements for RS-422 communication.

Power Switch

The rocker switch labeled 1/0 on the rear panel of the TCS turns the TCS on and off. Position 1 indicates power on, and position 0 indicates power off.

Below the power switch is a socket for connecting the ac line cord. In installations where the TCS is panel mounted, the power switch and line cord socket may be inaccessible to the user.

Line Voltage Selection Switch

Some units may have a the rotary switch to the left of the ac line cord socket to select one of two voltage ranges: 90-132V ac or 180-264V ac. In installations where the TCS is panel mounted, the line voltage selection switch may be inaccessible to the user. On the units without a Line Voltage Selection Switch, the correct line voltage range is auto-selected by the power supply.

Touch Panel

The touch panel lets the user enter menu choices or make other input simply by touching appropriately labeled areas on the screen. Application software running on the host computer generates the displays and touchkeys for the user.

The touch panel is a transparent switch matrix affixed to the front of the display. The switch matrix provides 120 separate switch locations that can be labeled with words or symbols on the underlying display. Individual switches are called touch cells, and are arranged in a matrix of 12 rows by 10 columns. The underlying display provides 24 lines by 80 columns of characters, so each touch cell is 2 lines high by 8 columns of characters wide.

Contrast Control

The thumbwheel labeled ◑ near the lower right corner of the rear panel is provided to adjust the contrast of the display. This adjustment allows the user to optimize the intensity of the display for different ambient light conditions. In installations where the TCS is panel mounted, the contrast control may be inaccessible to the user.

SET UP Switch

The rear panel SET UP switch allows the user to call up the Setup Screen to review or change the adjustable operating parameters of the TCS. This switch is used in installations that do not use the optional keyboard. If the optional keyboard is used, it is usually more convenient to use the Set Up key instead. (The Set Up key is located in the row of function keys at the top of the keyboard.) The rear panel SET UP switch and the keyboard Set Up key serve the same function.

Look under the heading, Using the Setup Screen, for instructions to operate the Setup Screen. In installations where the TCS is panel mounted, the rear panel SET UP switch may be inaccessible to the user.

Beeper

The user or host computer can cause the TCS to generate a beep for situations requiring audible feedback. One such case is to indicate closures of touch cells on the touch panel. The TCS can be programmed to automatically beep or remain silent whenever a touch cell is touched.

The TCS also beeps whenever it receives the character Ctrl/G. For example, the TCS beeps when Ctrl/G on the keyboard is pressed while the Local Echo parameter is turned on. (Ctrl/G is pressed by holding down the Ctrl key while typing G. Instructions for setting the Local Echo parameter are under the heading, Using the Setup Screen, later in this guide.)

Optional Keyboard

The optional keyboard plugs into the rear panel keyboard connector, shown in Figure 4. The optional keyboard and the touch panel are the two user interfaces to the TCS. All TCS functions that are accessible through the touch panel and the rear panel SET UP switch are also accessible using the keyboard. Each key or group of keys on the optional keyboard is described under the heading, Using the Optional Keyboard, in this guide.

There are two keycap LED indicators on the keyboard, one on the Caps Lock key and the other on the Scroll Lock key. These indicators light when the respective key is in the locked position.

CONNECTING TO THE HOST

The following paragraphs explain how to connect the TCS to a host computer. If the TCS is already connected to a host computer, these paragraphs may be skipped.

The first step in getting the TCS up and running is to connect it to the host computer. The TCS has an RS-232-C serial interface that allows it to be connected to the host directly or through modems.

The TCS supports full-duplex communication. Full-duplex communication is two-way serial data exchange where both parties can transmit and receive simultaneously.

Using Modems

Modems can be used to operate the TCS from a remote location over telephone lines. To connect to a modem, simply connect an RS-232-C cable between the serial port on the back of the TCS to the DTE (Data Terminal Equipment) connector on the modem. The user should follow the modem manufacturer's baud rate specifications when setting up the TCS. Instructions for setting the TCS baud rate can be found under the heading, Using the Setup Screen, later in this guide. Figure 5 shows how modems are connected to the TCS and host computer to create a communication link.

Direct-Connect

The TCS can be connected to the host computer directly (without modems) if the TCS and the host are less than 15 meters (50 feet) apart. To use the direct-connect method, the user must link the TCS and host with either a null-modem cable or a standard RS-232-C cable, depending on the configuration of the host. If the host is configured as DTE, a null-modem cable must be used to reverse the signal lines to simulate the effect of a modem. If the host is configured as DCE (Data Communication Equipment), a normal cable is used. Figure 6 shows how to use the direct-connect method. The TCS can also be connected directly using an RS-422-A interface. The RS-422-A interface should be used for direct connection if the host and the TCS are more than 15 meters (50 feet) feet apart.

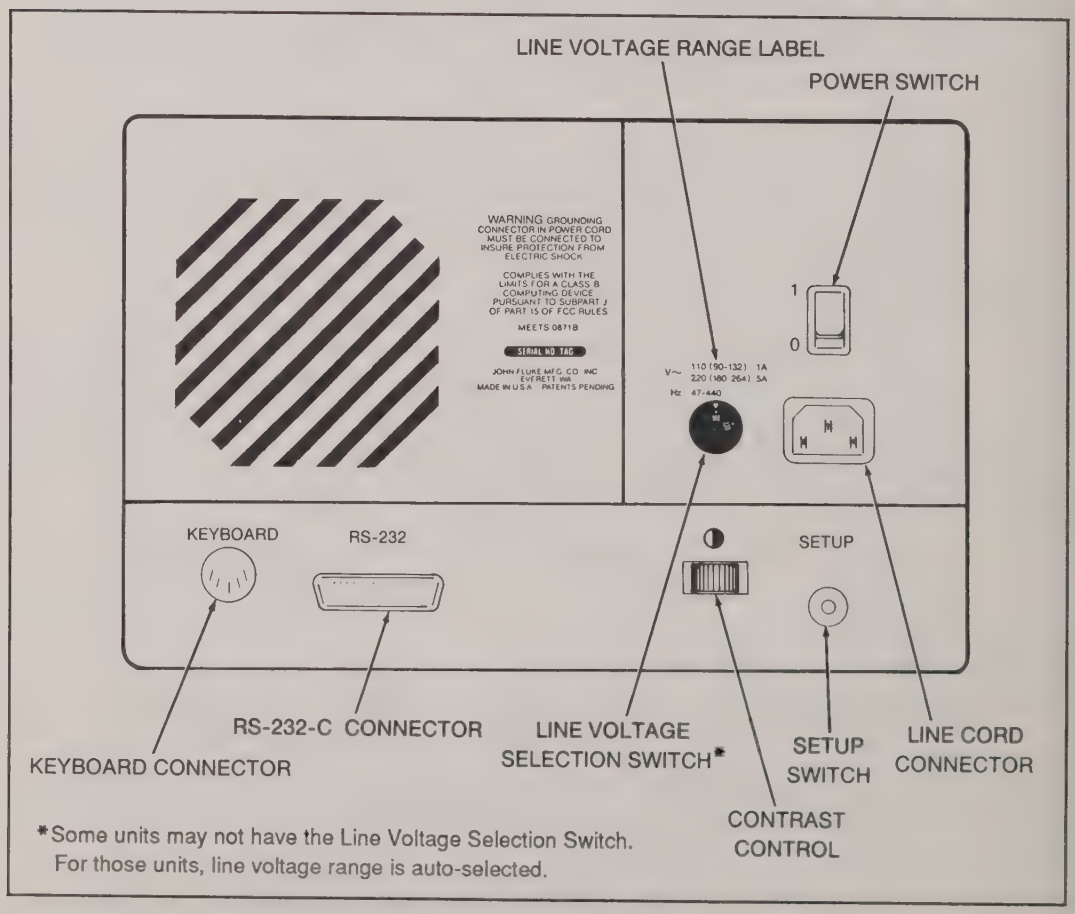

LINE VOLTAGE RANGE LABEL
POWER SWITCH
WARNING GROUNDING CONNECTOR IN POWER CORD MUST BE CONNECTED TO INSURE PROTECTION FROM ELECTRIC SHOCK
COMPLIES WITH THE LIMITS FOR A CLASS B COMPUTING DEVICE PURSUANT TO SUBPART J OF PART 15 OF FCC RULES
MEETS 08718
SERIAL NO TAG
JOHN FLUKE MFG CO INC EVERETT WA MADE IN U.S.A. PATENTS PENDING
V~ 110 (90-132) 1A 220 (180 264) 5A
Hz 47-440
1
0
KEYBOARD
RS-232
SETUP
KEYBOARD CONNECTOR
RS-232-C CONNECTOR
LINE VOLTAGE SELECTION SWITCH*
SETUP SWITCH
LINE CORD CONNECTOR
CONTRAST CONTROL
*Some units may not have the Line Voltage Selection Switch. For those units, line voltage range is auto-selected.

Figure 4. Rear Panel View

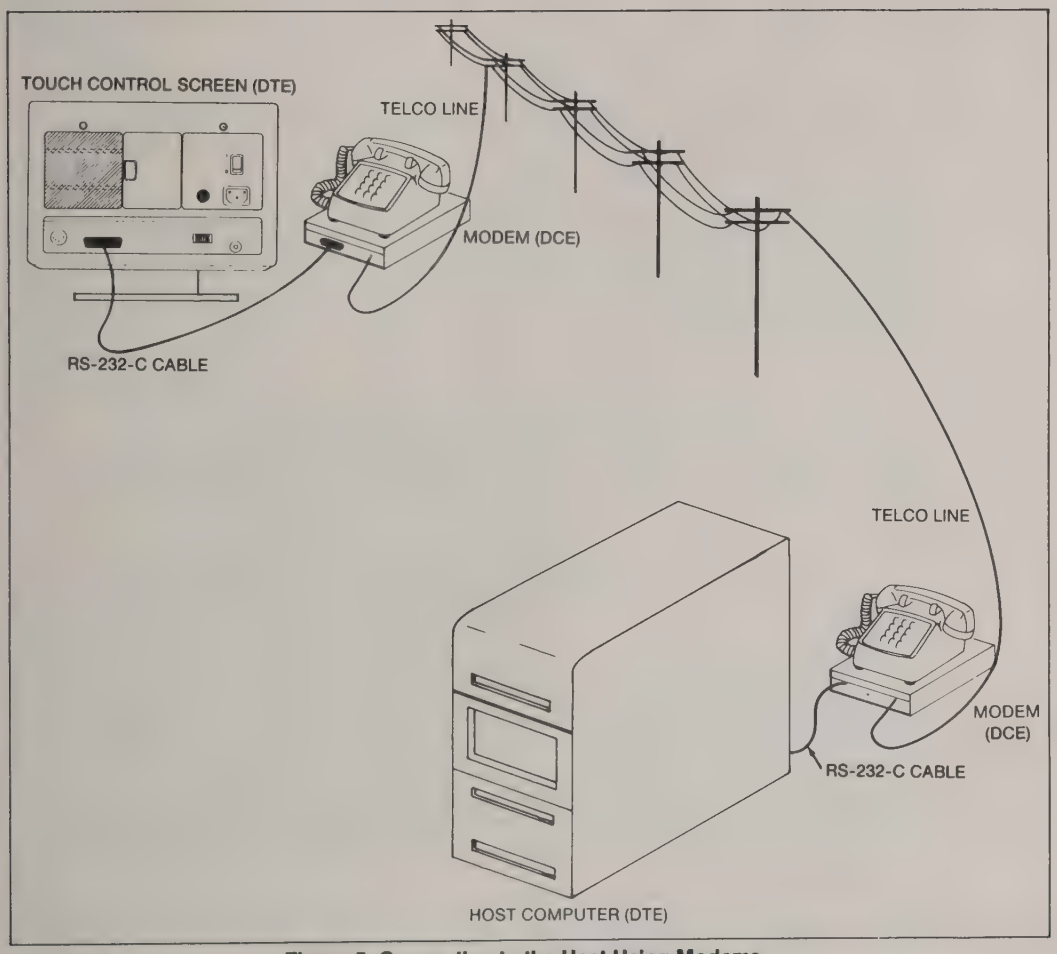


Figure 5. Connecting to the Host Using Modems

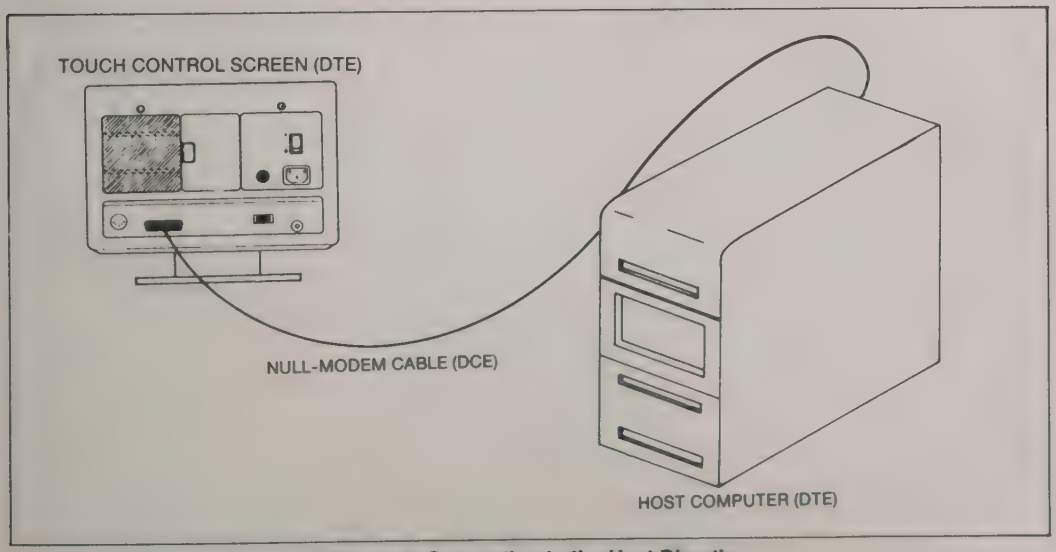


Figure 6. Connecting to the Host Directly

SELECTING LINE VOLTAGE

NOTE

The information under this heading applies only to units with a Line Voltage Selection Switch. Units without a Line Voltage Selection Switch select the correct line voltage range automatically.

The TCS is factory-configured for either 90-132V ac or 180-264V ac. Before turning the TCS on for the first time, check the line voltage selection switch on the rear panel to make sure the TCS is set to the proper line voltage. To operate the TCS at a different line voltage from that set on the switch, the line voltage selection switch setting must be changed.

CAUTION

Powering up the TCS with line voltage higher than 132V ac when the line voltage selection switch is in the 110 position may damage the power supply.

NOTE

The acceptable line voltage frequency for either voltage range is 47-440 Hz.

To change the line voltage setting, use the following procedure:

1. Insert a screwdriver blade into the slot on the line voltage selection switch rotor as shown in Figure 7.
2. For line voltages of 90-132V, rotate the screwdriver so that the 110 dot on the switch rotor aligns with the arrow at the top of the switch. For line voltages of 180-264V, rotate the screwdriver so that the 220 dot aligns with the arrow at the top of the switch.

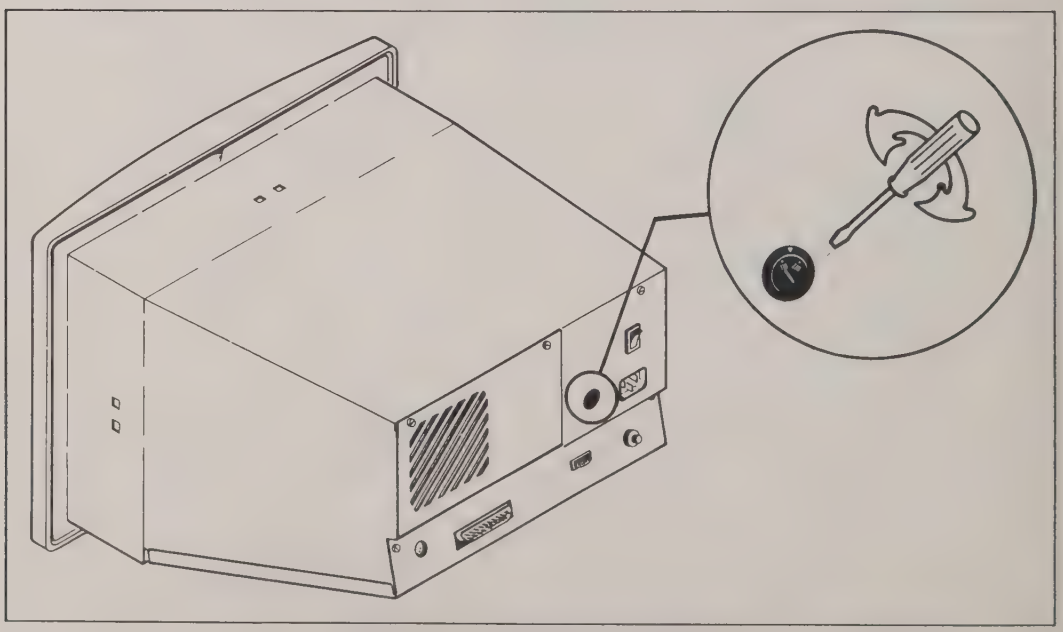


Figure 7. Selecting Line Voltage

TURNING ON THE TCS

When the TCS is powered up, it undergoes automatic self-testing. The following paragraphs explain the automatic self-tests and how the screen appears if the TCS passes or fails.

NOTE

The CRT requires up to 5 minutes for complete warm up. During this time, raster lines may appear on the display. This effect is common to CRT displays and is normal. The raster lines disappear when the CRT is completely warmed up.

Power-Up Sequence

Each time power is applied, the TCS conducts a series of four tests that check the system memory and the touch panel:

- ROM Checksum Test
- RAM Integrity Test
- Non-Volatile Setup Memory Checksum Test
- Touch Panel Closure Test

Whether or not an error is detected during the automatic testing, the TCS reports the self-test status in detail on the display and pauses to allow the user to view the report. The report remains on the display until any user or host activity clears the display. The TCS then begins normal operation. Since normal operation allows the host to overwrite an error message on the display, an operational status report showing the error is also placed in the Setup Screen. The normal power-up display is shown in Figure 8.

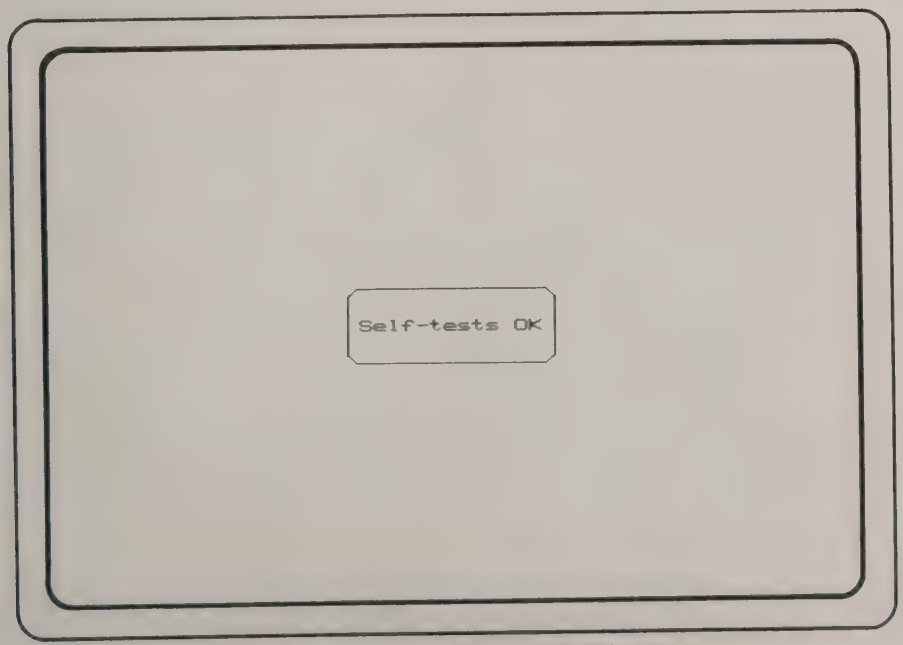


Figure 8. Normal Power-Up Display

ROM CHECKSUM TEST

The ROM Checksum Test automatically adds up all the values stored within each ROM (read-only memory) location. The ROM has been previously programmed so that the resulting sum should be zero. If the sum does not result in zero, an error message and the calculated (non-zero) checksum is displayed in hexadecimal.

RAM INTEGRITY TEST

During the RAM Integrity Test, the RAM (random-access memory) inside the TCS undergoes testing. When this test detects an error, the address where the error occurred is displayed in hexadecimal.

NON-VOLATILE SETUP MEMORY TEST

The Non-Volatile Setup Memory Checksum Test calculates the checksum of the non-volatile Setup memory. If the checksum is incorrect, the TCS reports an error, and to correct the checksum, attempts to program the non-volatile Setup memory using the factory default values in ROM. Then, if the non-volatile Setup memory is operating correctly, the error message will not recur.

TOUCH PANEL CLOSURE TEST

The Touch Panel Closure Test scans the entire touch panel for touch cells that are closed (shorted). If any touch cell closure is detected, the TCS issues an error report. The error report includes the decimal number of the first shorted touch cell detected.

NOTE

Powering up the TCS while touching the touch panel is interpreted as a touch panel failure, because the TCS checks the touch panel for closures during power-up.

If the touch panel contains a short, then the entire touch panel is automatically disabled. This prevents the touch panel from flooding the host computer with faulty touch reports.

TOUCHING THE TOUCH PANEL

The touch panel responds to fingertip pressure. A light touch is all that is needed to close a switch in the overlay. Although the touch panel surface is protected by a scratch-resistant coating, an accessory Contrast Enhancement Overlay provides additional protection in harsh environments. However, even with additional protection, sharp instruments should not be used to activate the touch panel.

For comfortable and error-free touch operation, the user should be located directly in front of the TCS, so that the screen is in the user's normal line of sight. This helps the user avoid long reaches that can become tiring, and ensures that parallax error will not cause the user to touch the display in the wrong place. (The distance from the surface of the touch panel to the image on the CRT, when viewed from an angle, can cause the user to misread the location of a touchkey. This error is called parallax error. See Figure 9.)

USING THE SETUP SCREEN

The Setup Screen is an interactive feature that allows the user to set the operating parameters of the TCS by making touch selections on the screen or by pressing keys on the optional keyboard.

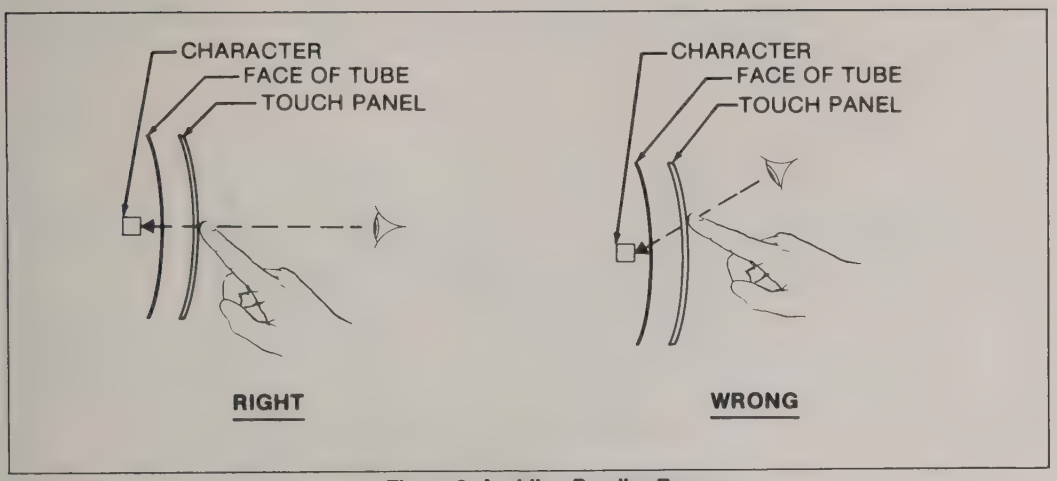


Figure 9. Avoiding Parallax Error

Some of the parameters are tailored toward user preference, such as choice of cursor type and background. Other parameters, such as Baud Rate and Parity Sense, determine how the TCS communicates with the host computer. Before operating the TCS, the user may need to configure some of the parameters so that the host computer can communicate with the TCS.

Major Divisions of the Setup Screen

The Setup Screen is functionally divided into three areas:

- Parameter List Area
- Direct Action Area
- Operational Status Window

These three areas of the Setup Screen are described in detail in the paragraphs that follow. The Setup Screen is shown in Figure 10.

PARAMETER LIST AREA

The Parameter List area is on the right side of the display; this is where the user selects a parameter and changes its value. This part of the Setup Screen lists all the Setup parameters and their current values. One entry in the list is highlighted; this entry is the parameter selected to be changed. The highlighted entry is always the parameter most recently changed since the TCS was last reset.

DIRECT ACTION AREA

The Direct Action area is on the left side of the display; this is where the user takes an immediate action not associated with a Setup parameter, such as exiting the Setup Screen or calling up the Alignment Screen. This part of the Setup Screen contains the software version number and touchkeys that operate the Setup Screen.

Each touchkey appearing on the display names the keyboard key that has the same function. This permits operation of the entire Setup Screen from either the touch panel or the optional keyboard.

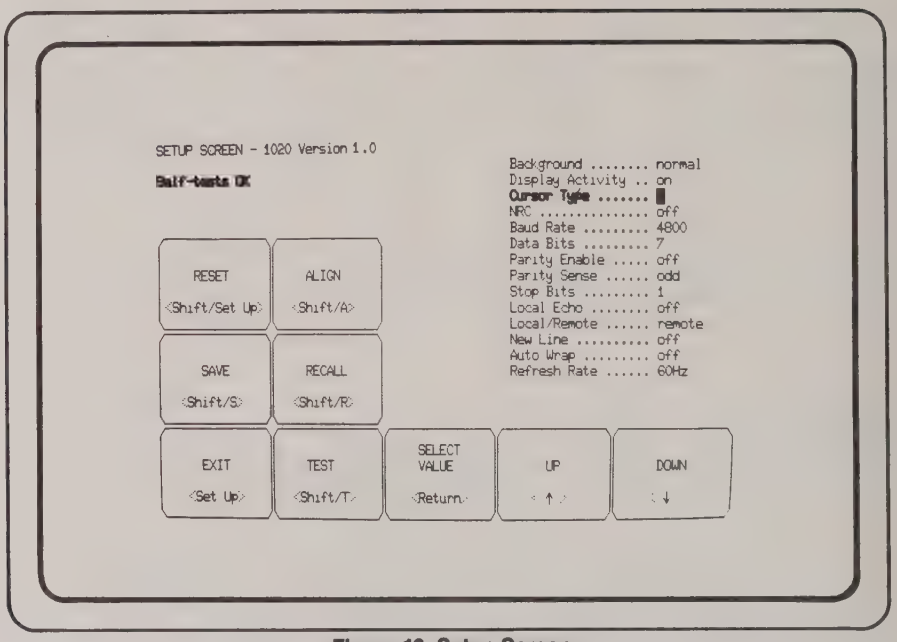


Figure 10. Setup Screen

The selection touchkeys, their keyboard equivalents, and their actions are outlined below. Procedures to change and save values of Setup parameters using these controls are given later in this guide.

- RESET Touchkey (or Shift/Set Up on the keyboard)

  This control executes a soft reset. A soft reset resets all Setup parameters to their last saved values, sounds the beeper, and initiates automatic power-up self-testing. (A hard reset, only accessible by remote command from the host, resets the TCS to its factory-programmed default state.)

- ALIGN Touchkey (or Shift/A on the keyboard)

  This control calls up the Alignment Screen. The Alignment Screen provides a means of adjusting the horizontal and vertical position of the display. Look under the heading, Aligning the Display, for more information.

- SAVE Touchkey (or Shift/S on the keyboard)

  This control executes a Save Setup command. A Save Setup command loads into non-volatile Setup memory all the parameter values as they are programmed in the current Setup session.

- RECALL Touchkey (or Shift/R on the keyboard)

  This control executes a Recall Setup command. The Recall Setup command overwrites all the parameter values programmed in the current Setup session with the values previously saved in non-volatile Setup memory with a Save Setup command.

- EXIT Touchkey (or the Set Up key on the keyboard)

  This control causes the TCS to exit the Setup Screen and resume normal operation.

- TEST Touchkey (or Shift/T on the keyboard)

  This control calls up the Test Screen. The Test Screen provides touch panel operation of user-selectable tests. For more information about testing the TCS, look under the heading, Problems.

- SELECT VALUE Touchkey (or the Return key on the keyboard)

  This control allows the user to scroll through the values of a Setup parameter until the user's choice appears.

- UP Touchkey (or the ↑ key on the keyboard)

  This control allows the user to select the next Setup parameter upward each time it is touched. When a parameter is selected, it is highlighted. The arrow touchkeys or keyboard keys are used to select a Setup parameter to be changed.

- DOWN Touchkey (or the ↓ key on the keyboard)

  This control allows the user to select the next Setup parameter downward each time it is touched. When a parameter is selected, it is highlighted. The arrow touchkeys or keyboard keys are used to select a Setup parameter to be changed.

OPERATIONAL STATUS WINDOW

The Operational Status Window is in the upper left of the display; it shows the operational status of the TCS. This part of the Setup Screen is a small scrolling region that contains a list of the four most recent status reports since power was turned on.

A status report is either a list of errors or a report that no errors have been encountered. When a new status report occurs, the oldest status report in the window is scrolled out of the window to make room for the new report. The most recent report is highlighted so the user can locate it quickly.

Status messages reported in the Operational Status Window can be any of the following:

- Communications framing error
- Communications overrun error
- Communications parity error
- Communications buffer overflow
- RAM test error at address - ⟨address⟩
- Non-volatile memory checksum error - ⟨checksum⟩
- ROM checksum error - ⟨checksum⟩

- Touch disabled: touch closure at key - ⟨number⟩
- Touch disabled: two closures in same row
- Self-tests OK

Error messages tell the user where to look for a problem. Service may be required. If a message contains a checksum or an address, these numbers are displayed in hexadecimal. For more information about failures, look under the heading, Problems, later in this guide.

How to Call Up and Exit the Setup Screen

To call up the Setup Screen, the user must either have access to the rear panel SET UP switch, or have the optional keyboard. (In installations where the TCS is panel mounted, the rear panel SET UP switch may be inaccessible to the user.)

To call up and exit the Setup Screen, use the following procedure:

1. To call up the Setup Screen, press the rear panel SET UP switch or the keyboard Set Up key.
2. To exit the Setup Screen, touch the EXIT touchkey, or press the SET UP switch or the Set Up key again.

NOTE

The host computer can block user access to the Setup Screen by setting the Setup Lockout mode. In this mode, the rear panel SET UP switch and the keyboard Set Up key are disabled. This may be done by the application software running on the host computer in situations where user access to Setup parameters needs to be restricted.

How to Change Setup Parameters

To select a Setup parameter and assign a value to it, use the following procedure:

NOTE

See the heading, Descriptions of the Setup Parameters, for information about the different Setup parameter values.

1. Move the highlighted field over the parameter desired by pressing the UP or DOWN touchkey (below the parameter list on the display), or by pressing the up or down arrow key on the optional keyboard.
2. Scroll through the range of the parameter's values until the desired value appears by pressing the SELECT VALUE touchkey (or by pressing the Return key on the optional keyboard). As soon as a parameter's value appears, the setting takes effect. The only exception is setting the Display Activity parameter to off, which takes effect immediately on exiting the Setup Screen.

Now the user is ready to select and change another parameter. When the user is satisfied with the setting of all the parameters, the parameters can be saved in non-volatile Setup memory. (The user does not have to save the parameters in memory, but if they are saved, the TCS will power-up the next time with these Setup parameter values automatically selected. If the user does not save the parameter settings, they are volatile. Volatile settings are lost when power is turned off.) Instructions for saving Setup Parameters follow.

How to Save Setup Parameters

To save the selected parameters, press the SAVE touchkey or press Shift/S (by holding down Shift while typing S on the optional keyboard).

After the Setup parameters are saved, they will remain selected even after power is turned off. The next time power is turned on, the TCS will be programmed with the previously saved parameter values. The only exception is the Local/Remote parameter value, which cannot be saved in memory. The Local/Remote parameter is always set to Remote at power-up so the host can communicate with the TCS when the TCS is turned on.

Volatility of Setup Parameters

The first time power is applied to the TCS, each Setup parameter is set to its original factory-programmed default value. (The default value of each Setup parameter is listed in Table 1.) After saving values of Setup parameters in the Setup Screen, those new values are saved in non-volatile memory for future recall.

A soft reset is executed at power-up and when the user presses the RESET touchkey on the Setup Screen. On soft reset, the TCS recalls the Setup parameter values saved in the last Setup Screen session.

Table 1. Default Values of Setup Parameters

PARAMETER	DEFAULT VALUE
Background	normal
Display Activity	on
Cursor Type	slow-blinking block
NRC	off
Baud Rate	4800
Data Bits	7
Parity Enable	off
Parity Sense	odd
Stop Bits	1
Local Echo	off
Local/Remote	remote
New Line	off
Auto-Wrap	off
Refresh Rate	60 Hz

Descriptions of the Setup Parameters

Parameters that are programmable by the user through the Setup Screen are described in the following paragraphs. Some of the parameters may also be programmed by remote commands from the host computer; these parameters are labeled "remote programmable". The default values listed for parameters are the values assigned to parameters when the TCS is first powered up and the values reassigned to the parameters on each hard reset. (A hard reset, only accessible by remote command from the host, resets the TCS to its factory-programmed default state.)

- Background (Remote Programmable) Default: normal

  The Background parameter selects light characters against a dark background (normal video) or dark characters against a light background (reverse video).

- Display Activity (Remote Programmable) Default: on

  The Display Activity parameter sets the display to stay on as long as power is on, sets the display to be blanked, or sets the display to turn off automatically after 30 minutes of inactivity (timeout). The timeout can be used to extend the life of the phosphor on the CRT display. After the display has timed out, any activity by the user or host causes the display to be turned back on. The first touch, keystroke, or activation of the rear panel SET UP switch by the user that turns the display back on only serves to reactivate the display; any other action normally caused by that entry does not occur.

  When the Display Activity parameter is set to off, the display is turned off. The display remains off, even if there is user or host activity, until the display activity is changed to on or timeout, or the user presses the Set Up key or rear panel SET UP switch.

  NOTE

  Regardless of the setting of the Display Activity parameter, the display always becomes visible when the user presses the rear panel SET UP switch or the keyboard Set Up key. A Display Activity parameter setting of off only takes effect when the Setup Screen is exited.

- Cursor Type (Remote Programmable) Default: (slow-blinking block)

  The Cursor Type parameter sets the cursor to the user's choice of a reverse-video block or an underline character, or makes the cursor invisible. The block or underline can be steady, slow blinking, or fast blinking. The cursor itself is shown as the value of the Cursor Type parameter.

- NRC (Remote Programmable) Default: off

  The NRC (National Replacement Code) parameter lets the user or host select a substitute set of international characters for display on the screen. The international characters replace the normally-represented ASCII characters that are printed on the keycaps on the optional keyboard. (ASCII stands for American Standard Code for Information Interchange, a standardized code set for characters, numerics, and control characters.) Table 2 shows the NRC parameter value for each set of international characters available, and shows which ASCII characters are replaced by the NRC characters.

  For an example of how the NRC parameter works, a German user, after setting the NRC parameter to German, can use the TCS and host computer to create a text file that contains international characters that appear in German printing. For example, if a text file contains the ASCII characters "pr}fung", those characters appear on the screen as, "prüfung". Any time this file is viewed with the NRC parameter set to German, the text appears as intended. However, if the same file is viewed with the NRC parameter set to "off", international characters particular to German appear as standard ASCII symbolic characters (such as @, [, etc.). This occurs because the keyboard, the host computer, and the file communicate using the standard ASCII codes for the special characters.

  NOTE

  The keyboard displayed by the Keyboard Test reflects the NRC selected. This allows the user to easily identify the characters used by the selected NRC and keys under which these characters reside. (The Keyboard Test is described under the heading, Keyboard Test, later in this guide.)

Table 2. National Replacement Code Characters

NATIONALITY	CHARACTER RECEIVED	CHARACTER DISPLAYED	DESCRIPTION OF DISPLAYED CHARACTER
Danish	@	Ä	A umlaut
	]	Å	A ring
	[	Æ	A E ligature
	\	Ø	O slash
	^	Ü	U umlaut
	`	ä	a umlaut
	}	å	a ring
	{	æ	a e ligature
	|	ø	o slash
	~	ü	u umlaut
Dutch	#	£	pound symbol
	@	¾	fraction 3/4
	[	ij	i j ligature
	\	½	fraction 1/2
	]	|	vertical bar
	{	¨	umlaut (bare)
	|	*f*	script f
	}	¼	fraction 1/4
	~	'	single quote
French	#	£	pound symbol
	]	§	section sign
	[	°	degree sign
	@	à	a grave
	\	ç	c cedilla
	}	è	e grave
	{	é	e acute
	|	ù	u grave
	~	¨	umlaut (bare)
Canadian	@	à	a grave
	[	â	a circumflex
	\	ç	c cedilla
	}	è	e grave
	{	é	e acute
	]	ê	e circumflex
	^	î	i circumflex
	`	ô	o circumflex
	|	ù	u grave
	~	û	u circumflex

Table 2. National Replacement Code Characters (cont)

NATIONALITY	CHARACTER RECEIVED	CHARACTER DISPLAYED	DESCRIPTION OF DISPLAYED CHARACTER
Finnish	[	Ä	A umlaut
	]	Å	A ring
	\	Ö	O umlaut
	^	Ü	U umlaut
	{	ä	a umlaut
	}	å	a ring
	`	è	e grave
	|	ö	o umlaut
	~	ü	u umlaut
German	@	§	section sign
	[	Ä	A umlaut
	\	Ö	O umlaut
	]	Ü	U umlaut
	~	ß	German small sharp s
	{	ä	a umlaut
	|	ö	o umlaut
	}	ü	u umlaut
Italian	#	£	pound symbol
	@	§	section sign
	[	°	degree sign
	~	ì	i grave
	{	à	a grave
	\	ç	c cedilla
	}	è	e grave
	]	é	e acute
	|	ò	o grave
	`	ù	u grave
Spanish	#	£	pound symbol
	[	¡	inverted !
	@	§	section sign
	{	°	degree sign
	]	¿	inverted ?
	\	Ñ	N tilde
	}	ç	c cedilla
	|	ñ	n tilde
Swedish	@	È	E grave
	[	Ä	A umlaut
	]	Å	A ring
	\	Ö	O umlaut
	^	Ü	U umlaut
	{	ä	a umlaut
	}	å	a ring
	`	è	e grave
	|	ö	o umlaut
	~	ü	u umlaut

Table 2. National Replacement Code Characters (cont)

NATIONALITY	CHARACTER RECEIVED	CHARACTER DISPLAYED	DESCRIPTION OF DISPLAYED CHARACTER
Swiss	@	à	a grave
	{	ä	a umlaut
	\	ç	c cedilla
	_	è	e grave
	[	é	e acute
	]	ê	e circumflex
	^	î	i circumflex
	`	ô	o circumflex
	!	ö	o umlaut
	~	û	u circumflex
	}	ü	u umlaut
UK	#	£	pound symbol

- Baud Rate — Default: 4800

The Baud Rate parameter sets the data transmission and reception speed to one of eight baud rates:

110, 300, 600, 1200, 2400, 4800, 9600, 19200

The baud rate setting selects both transmit and receive speeds. The TCS does not allow transmitting at one speed and receiving at another.

- Data Bits — Default: 7

The Data Bits parameter selects either seven or eight data bits per ASCII character for sending and receiving data. If Data Bits is set to 7, after a start bit is received, only the next seven bits are interpreted as data. Operation with seven data bits allows direct addressing of the Standard Character Set only (the lower 128 characters, or ASCII character set), and requires the use of the Select Character Set command (from the host) to display Extended Characters (the next 128 characters above the Standard Character Set). If the Data Bits parameter is set to 8, after a start bit is received, the next eight bits are interpreted as data. This gives the host computer direct access to the entire character set of Standard and Extended Characters.

- Parity Enable — Default: off
- Parity Sense — Default: odd

The Parity Enable and Parity Sense parameters are used to enable or disable parity checking, and to choose odd or even parity. By setting these two parameters, a parity bit can be used in five different ways, as shown in Table 3.

Parity checking is a method of detecting communication errors. When parity checking is enabled, a parity bit is appended to the data bits of each transmitted character, and checked on each received character. The TCS uses either even or odd parity checking.

Table 3. Touch Control Screen Parity Settings

PARITY ENABLE SETTING	PARITY SENSE SETTING	EFFECT
Off	Even or odd	Parity checking and generation are disabled. The TCS does not transmit a parity bit and does not expect parity bits in the data it receives. A received character containing a parity bit is displayed as a framing error (F_E).
On	Even	Parity checking and generation are enabled. The TCS transmits even-parity data by appending a parity bit and expects received data to have even parity. If the TCS receives data that has odd parity, the data is displayed as a parity error (P_E).
On	Odd	Parity checking and generation are enabled. The TCS transmits odd-parity data by appending a parity bit and expects received data to have odd parity. If the TCS receives data that has even parity, the data is displayed as a parity error (P_E).
Ignore	Even	Parity checking is disabled, but even parity generation is enabled. The TCS transmits even-parity data by appending a parity bit and expects received data to have a parity bit. However, the TCS does not check the parity of the received data.
Ignore	Odd	Parity checking is disabled, but odd parity generation is enabled. The TCS transmits odd-parity data by appending a parity bit and expects received data to have a parity bit. However, the TCS does not check the parity of the received data.

Even parity means that the parity bit and the data bits together contain an even number of binary 1s. For example, for the data bits 1010100, the parity bit is 1, making the total number of 1s even (in this example there are a total of four 1s).

Odd parity means that the parity bit and the data bits together contain an odd number of binary 1s. For example, for the data bits 1010100, the parity bit is 0, making the total number of 1s odd (in this example there are a total of three 1s).

When parity checking is active, the TCS tests each received character for correct parity. If a character fails the parity test, the TCS prints the parity error character (P_E) on the screen.

- Stop Bits — Default: 1

The Stop Bits parameter sets the TCS to send and receive characters having either one or two stop bits. If the Stop Bits parameter is set to 1, then only one stop bit per character is used for both transmitting and receiving over the host serial interface.

If the Stop Bits parameter is set to 2, then two stop bits are used for both transmitting and receiving. Most systems use one stop bit.

- Local Echo (Remote Programmable) Default: off

The Local Echo parameter determines if keyboard input is echoed to the display as well as sent to the host computer. When the Local Echo parameter is set to off, keyboard input is only sent to the host. The host may or may not echo the data back to the TCS to be displayed or acted upon. When the Local Echo parameter is set to on, all keyboard input is echoed to the display and is also sent to the host. Normally, the host echoes keyboard entries to the TCS, in which case the Local Echo parameter should be set to off. Touch panel input is not affected in any way by the setting of the Local Echo parameter; touch panel input is never echoed.

- Local/Remote Default: remote

The Local/Remote parameter controls whether the TCS accepts commands from the host (remote) or from the optional keyboard (local). When the Local/Remote parameter is set to remote, commands received from the host are interpreted normally. Keyboard input is merely passed on to the host. (This setting is used in normal operation.)

When the Local/Remote parameter is set to local, commands received from the host are temporarily ignored. Instead, input received from the keyboard is interpreted as if it had come from the host. This allows the user to generate remote commands locally from the keyboard. All keyboard input is interpreted as coming from the host except for Set Up key input and input while the Setup, Test, and Alignment Screens are called up.

NOTE

The Local/Remote Setup parameter is the only Setup parameter that is not stored and recalled by the Save Setup and Recall Setup commands. Look under the heading, Volatility of Setup Parameters, earlier in this guide, for details.

- New Line (Remote Programmable) Default: off

The New Line parameter selects the control character or characters that the TCS transmits when the user presses the Return key, and when the user presses the Enter key if the auxiliary keypad is in the numeric mode. The New Line parameter also determines the action taken by the TCS when it receives the ASCII characters line feed ⟨LF⟩, form feed ⟨FF⟩, or vertical tab ⟨VT⟩. The choices for the New Line parameter and the resulting effects on characters sent to the host are shown in Table 4. The effects of the New Line parameter on cursor movement are shown in Table 5.

Table 4. Effects of the New Line Parameter on Characters Sent to the Host

KEYBOARD INPUT	CHARACTERS SENT TO THE HOST	
	New Line off	New Line on
Return	TCS sends ⟨CR⟩	TCS sends ⟨CR⟩⟨LF⟩
Enter*	TCS sends ⟨CR⟩	TCS sends ⟨CR⟩⟨LF⟩
*When keypad is in numeric mode		

Table 5. Effects of the New Line Parameter on Cursor Movement

HOST OUTPUT	RESULTING CURSOR MOVEMENT	
	New Line off	New Line on
⟨LF⟩, ⟨FF⟩, or ⟨VT⟩	Moves cursor to next line, same column.	Moves cursor to next line, left margin.

- Auto Wrap (Remote Programmable) Default: off

  The Auto Wrap parameter determines whether the cursor moves to the beginning of the next line when the TCS receives characters that run off the right margin (column 80) of the display. When the Auto Wrap parameter is set to off, a display character received when the cursor is at the right margin replaces the previously displayed character, and the cursor remains stationary.

  When the Auto Wrap parameter is set to on, a display character received (other than the tab character ⟨HT⟩) when the cursor is at the right margin is displayed on the next line at the left margin. Note that the tab character ⟨HT⟩ never moves the cursor to the next line.

- Refresh Rate Default: 60 Hz

  The Refresh Rate parameter sets the display refresh rate to either 50 Hz or 60 Hz. This parameter is used to minimize display interference when the TCS is powered by either 50 Hz or 60 Hz ac power. Refresh Rate should be set to the same frequency as the line power if there is line power interference. There is less perceived flicker, however, at the 60 Hz setting, so the user should try both settings to see which setting produces the best results.

ALIGNING THE DISPLAY

The Alignment Screen (Figure 11) provides a way to adjust the horizontal and vertical position of the display on the face of the cathode-ray tube (CRT) to compensate for different viewing angles or drift of the displayed image due to aging. The Alignment Screen can be used to adjust the display for optimum alignment under any conditions.

The Alignment Screen consists of a cross-hair alignment pattern, four movement controls, and an EXIT touchkey. (If the cursor is normally visible, it is made invisible while the Alignment Screen is called up. The cursor returns to its previous state when the user exits the Alignment Screen.)

As an alignment aid, the bezel on the front of the TCS contains four alignment marks, as shown in Figure 12. A flexible straight edge can be used to verify precise alignment between the cross-hair alignment pattern and the bezel alignment marks.

NOTE

The Alignment Screen is called up through the Setup Screen, so it can be used only in systems that have access to the Setup Screen.

Use the following procedure to align the display:

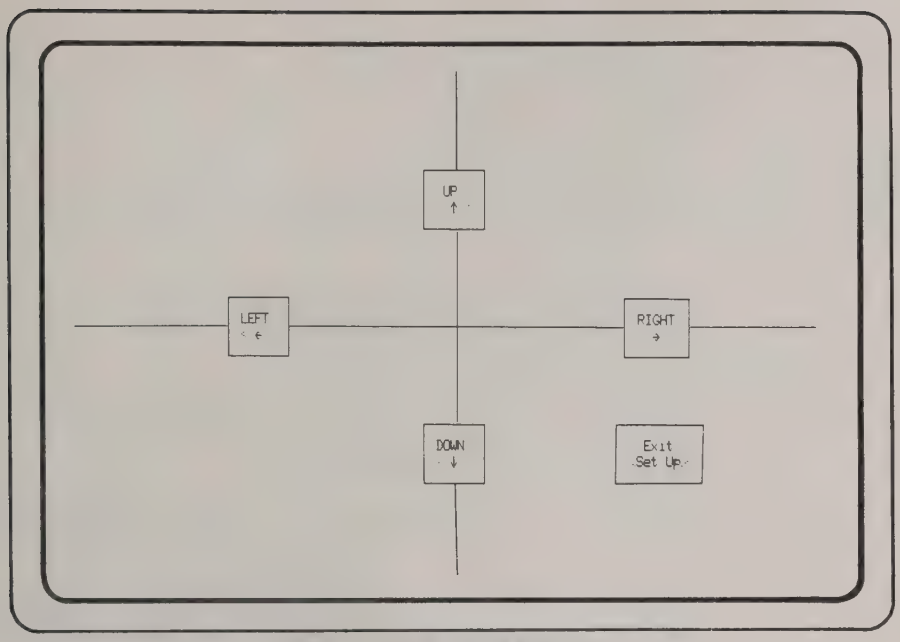


Figure 11. Alignment Screen

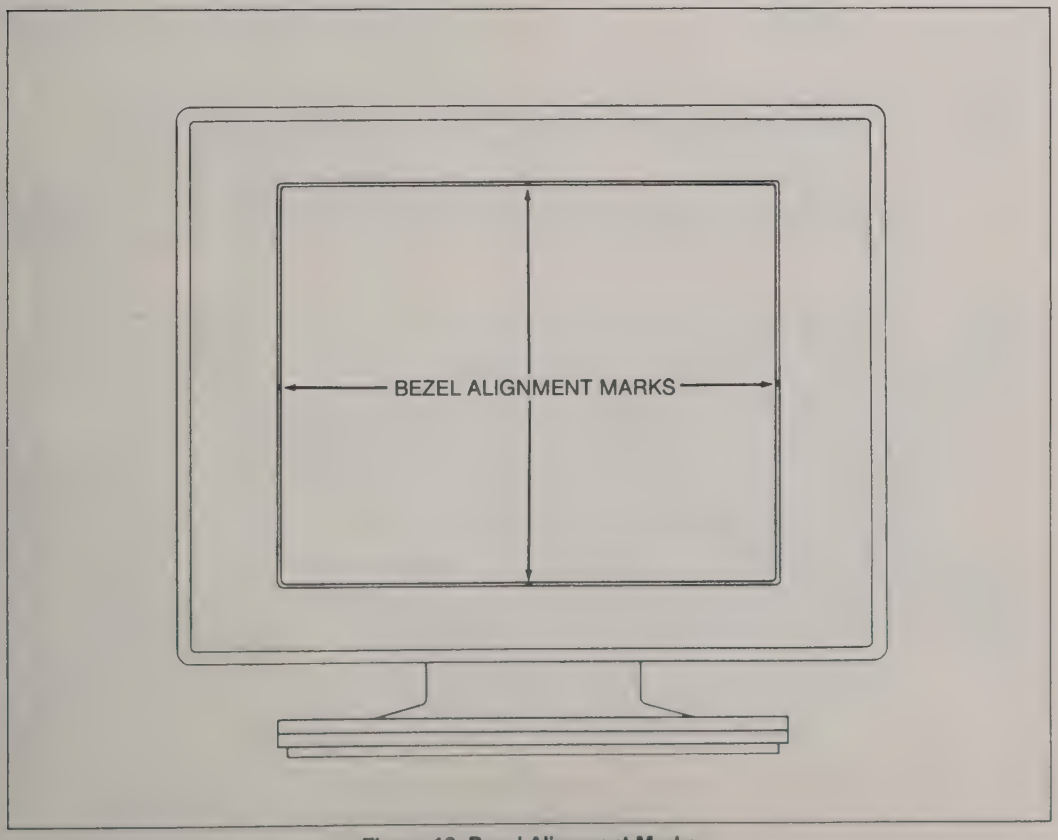


Figure 12. Bezel Alignment Marks

1. Call up the Setup Screen by pressing the rear panel SET UP switch (if accessible) or by pressing the Set Up key on the optional keyboard.

2. Call up the Alignment Screen by touching the ALIGN touchkey or by typing Shift/A on the keyboard.

3. Position the display in the user's normal line of sight. The user should be facing the screen as directly as possible.

4. Touch the LEFT or RIGHT touchkeys, or press the left or right arrow keys on the keyboard, until the displayed cross-hair target appears to lie directly in line with top and bottom bezel alignment marks.

5. Touch the UP or DOWN touchkeys, or press the up or down arrow keys on the keyboard, until the displayed cross-hair target appears to lie directly in line with left and right bezel alignment marks.

6. Touch the EXIT touchkey, or press Set Up on the keyboard to exit the Alignment Screen and reenter the Setup Screen.

7. Touch the SAVE touchkey on the Setup Screen or type Shift/S on the keyboard to save the new display alignment in the non-volatile Setup memory.

8. Touch the EXIT touchkey, or press Set Up on the keyboard to resume normal operation.

USING THE OPTIONAL KEYBOARD

The optional keyboard has keys similar to those on an ordinary typewriter as well as some special keys. The keyboard contains standard keys, a Set Up key, cursor control keys, special function keys, and an auxiliary keypad. The keyboard layout is shown in Figure 13.

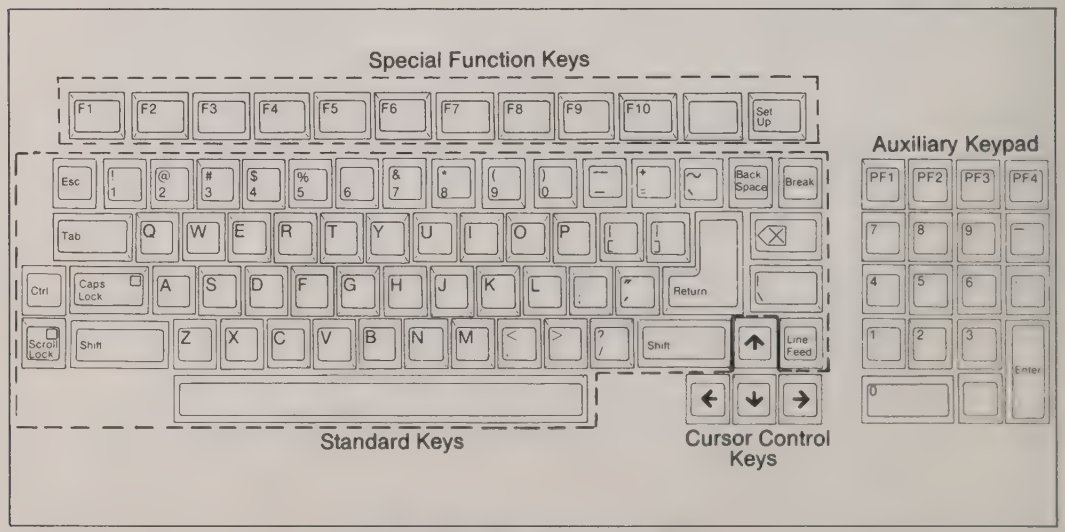


Figure 13. Optional Keyboard

Standard Keys

The standard keys generate ASCII characters. The standard keys have the names of ASCII characters printed on the keycaps and generate only ASCII codes.

Some of the non-alphanumeric keys are described below. Note that the function of most of these keys is ultimately determined by the application software running on the host computer. The ASCII codes sent to the host computer by the non-alphanumeric standard keys are shown in Table 6.

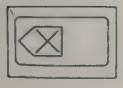
Table 6. Non-Alphanumeric Standard Key Codes

KEY	CODE(S) SENT TO HOST (HEXADECIMAL)	ASCII MNEMONIC
⌫	7F	⟨DEL⟩
Tab	9	⟨HT⟩
Return	D or D A*	⟨CR⟩ or ⟨CR⟩ ⟨LF⟩*
Line Feed	A	⟨LF⟩
Space Bar	20	⟨SPACE⟩
Esc	1B	⟨ESC⟩
Back Space	8	⟨BS⟩

* Depends on the state of the New Line parameter.

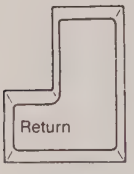
The Back Space key normally causes the cursor to move one space to the left. However, the function of the Back Space key is determined by the application software running on the host computer.

The Break key generates a short break when pressed alone, or a long break when pressed in conjunction with the Shift key. The Break key normally resets the communication interfaces with a device attached to the TCS. However, the function of the Break key is determined by the types of peripherals connected to the TCS and the application software running on the host computer.



This is the delete key. The delete key normally moves the cursor one space to the left, deleting the character that occupied the space. However, the function of the delete key is determined by the application software running on the host computer.

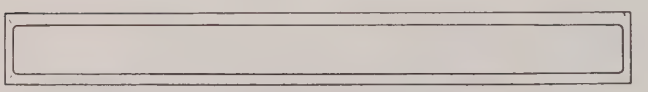
The Line Feed key normally moves the cursor one line down. However, the function of the Line Feed key is determined by the application software running on the host computer.



The Return key sends either the ASCII character ⟨CR⟩ or the ASCII character sequence ⟨CR⟩ ⟨LF⟩ to the host depending on the state of the New Line parameter. (The New Line parameter is one of the changeable Setup parameters accessed through the Setup Screen. Look under the heading, Using the Setup Screen, for more information.)

The Return key normally moves the cursor to the first column of the next line. However, the action caused by sending ⟨CR⟩ or ⟨CR⟩ ⟨LF⟩ to the host computer is determined by the application software running on the host computer.

The Shift key alone does not generate a code. It is used with other standard keys to send upper-case characters, by holding down Shift while pressing another key. These characters can be either capital letters or the upper-case symbols.



The Space Bar normally moves the cursor one space to the right, leaving an invisible space character in its place. However, the function of the Space Bar is determined by the application software running on the host computer.

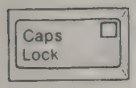
The Scroll Lock key freezes the display whether or not the host supports XON/XOFF or hardware handshaking flow control. There is no interaction between Ctrl/Q, Ctrl/S, and Scroll Lock.

The Ctrl key alone does not send a code. It is used with other standard keys to send control codes by holding down the Ctrl key while pressing another key. For example, the Ctrl key can be used to send a control code that causes the TCS to beep. The keystrokes Ctrl/G (when echoed to the TCS) normally cause the beeper to sound. Table 7 shows the characters that are transmitted by the TCS when various keys are pressed with the Ctrl key. The action caused by sending these control codes to the host computer is determined by the application software running on the host computer.

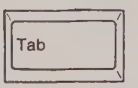
Table 7. Characters Sent by Keys Pressed with Ctrl

KEY (PRESSED WITH CTRL KEY)	CODE SENT TO HOST (HEXADECIMAL)	ASCII MNEMONIC
2 or Space Bar	00	⟨NULL⟩
A	01	⟨SOH⟩
B	02	⟨STX⟩
C	03	⟨ETX⟩
D	04	⟨EOT⟩
E	05	⟨ENQ⟩
F	06	⟨ACK⟩
G	07	⟨BEL⟩
H	08	⟨BS⟩
I	09	⟨HT⟩
J	0A	⟨LF⟩
K	0B	⟨VT⟩
L	0C	⟨FF⟩
M	0D or DA*	⟨CR⟩ or ⟨CR⟩⟨LF⟩*
N	0E	⟨SO⟩
O	0F	⟨SI⟩
P	10	⟨DLE⟩
Q	11	⟨DC1⟩ (XON)
R	12	⟨DC2⟩
S	13	⟨DC3⟩ (XOFF)
T	14	⟨DC4⟩
U	15	⟨NAK⟩
V	16	⟨SYN⟩
W	17	⟨ETB⟩
X or ⌫	18	⟨CAN⟩
Y	19	⟨EM⟩
Z	1A	⟨SUB⟩
3 or [	1B	⟨ESC⟩
4 or \	1C	⟨FS⟩
5 or]	1D	⟨GS⟩
6 or ~ or `	1E	⟨RS⟩
7 or ? or /	1F	⟨US⟩
8	7F	⟨DEL⟩

*Depends on the state of the New Line parameter (set in the Setup Screen).



The Caps Lock key locks when pressed, and unlocks when pressed again. When the Caps Lock key is locked, all alphabetic keys generate capital letters. When the Caps Lock key is unlocked, all alphabetic keys generate lower-case letters (unless an alphabetic key is pressed along with the Shift key). Numeric or symbolic keys are unaffected by the Caps Lock key. The LED indicator on the Caps Lock key is lit when the key is locked, and off when the key is unlocked.



The Tab key normally moves the cursor one tab space to the right. However, the function of the Tab key is determined by the application software running on the host computer.

The Esc key generates the ASCII character ⟨ESC⟩. The function of the Esc key is determined by the application software running on the host computer.

The Set Up Key

The Set Up key does not transmit anything to the host computer. It is used to call up Setup Screen, and to exit the Setup, Test, and Alignment Screens. It has exactly the same function as the rear panel SET UP switch. See the heading, Using the Setup Screen, for more information.

Cursor Control Keys

The cursor control keys transmit ANSI cursor control sequences to the host as shown in Table 8. These are special sequences of ASCII characters defined by the American National Standards Institute. Cursor control sequences are also called escape sequences.

The cursor control keys normally move the cursor on the screen. However, the function of the cursor control keys is determined by the application software running on the host computer.

Table 8. Cursor Control Key Codes

KEY	CODE SEQUENCE SENT TO HOST	ACTION TAKEN IF ECHOED TO THE TCS
↑	⟨ESC⟩ [A	Moves the cursor one line up
↓	⟨ESC⟩ [B	Moves the cursor one line down
→	⟨ESC⟩ [C	Moves the cursor one space to the right
←	⟨ESC⟩ [D	Moves the cursor one space to the left

Special Function Keys

The special function keys transmit escape sequences to the host as shown in Table 9. (An escape sequence is a series of ASCII characters beginning with the ⟨ESC⟩ character.) The special function keys may also be pressed with the Shift key or the Ctrl key to generate additional escape sequences. How the host computer responds to these escape sequences depends on the application software. In this model, the unlabeled special function key does not send any codes to the host.

Table 9. Special Function Key Codes

KEY(S)	CODE SEQUENCE SENT TO HOST
F1	⟨ESC⟩[01~
F2	⟨ESC⟩[02~
F3	⟨ESC⟩[03~
F4	⟨ESC⟩[04~
F5	⟨ESC⟩[05~
F6	⟨ESC⟩[06~
F7	⟨ESC⟩[07~
F8	⟨ESC⟩[08~
F9	⟨ESC⟩[09~
F10	⟨ESC⟩[10~
Shift/F1	⟨ESC⟩[11~
Shift/F2	⟨ESC⟩[12~
Shift/F3	⟨ESC⟩[13~
Shift/F4	⟨ESC⟩[14~
Shift/F5	⟨ESC⟩[15~
Shift/F6	⟨ESC⟩[16~
Shift/F7	⟨ESC⟩[17~
Shift/F8	⟨ESC⟩[18~
Shift/F9	⟨ESC⟩[19~
Shift/F10	⟨ESC⟩[20~
Ctrl/F1	⟨ESC⟩[21~
Ctrl/F2	⟨ESC⟩[22~
Ctrl/F3	⟨ESC⟩[23~
Ctrl/F4	⟨ESC⟩[24~
Ctrl/F5	⟨ESC⟩[25~
Ctrl/F6	⟨ESC⟩[26~
Ctrl/F7	⟨ESC⟩[27~
Ctrl/F8	⟨ESC⟩[28~
Ctrl/F9	⟨ESC⟩[29~
Ctrl/F10	⟨ESC⟩[30~

Auxiliary Keypad

The auxiliary keypad is the group of keys on the right side of the keyboard. The auxiliary keypad can be programmed by the host computer to generate either ASCII numeric codes or special escape sequences called application codes. Auxiliary keypad codes transmitted to the host are shown in Table 10.

CARING FOR THE TOUCH CONTROL SCREEN

To keep the TCS looking like new, occasionally clean the touch panel, the optional enclosure, and the optional keyboard. The next paragraphs give guidelines for cleaning the parts of the TCS.

CAUTION

Do not use aromatic hydrocarbons such as gasoline or other fuels, or chlorinated solvents for cleaning. They may damage plastic materials used in the TCS.

Table 10. Auxiliary Keypad Codes

KEY	NUMERIC CODES SENT TO HOST	APPLICATION CODES SENT TO HOST
0	0	⟨ESC⟩ O p
1	1	⟨ESC⟩ O q
2	2	⟨ESC⟩ O r
3	3	⟨ESC⟩ O s
4	4	⟨ESC⟩ O t
5	5	⟨ESC⟩ O u
6	6	⟨ESC⟩ O v
7	7	⟨ESC⟩ O w
8	8	⟨ESC⟩ O x
9	9	⟨ESC⟩ O y
-	-	⟨ESC⟩ O m
,	,	⟨ESC⟩ O l
.	.	⟨ESC⟩ O n
Enter	⟨CR⟩ or ⟨CR⟩ ⟨LF⟩*	⟨ESC⟩ O M
PF1	⟨ESC⟩ O P	⟨ESC⟩ O P
PF2	⟨ESC⟩ O Q	⟨ESC⟩ O Q
PF3	⟨ESC⟩ O R	⟨ESC⟩ O R
PF4	⟨ESC⟩ O S	⟨ESC⟩ O S

*Depends on the state of the New Line parameter (set in the Setup Screen).

Cleaning the Touch Panel

Clean the touch panel and any overlays with a soft cloth or lens tissue slightly dampened with a commercially available lens or CRT cleaner, or a non-abrasive household cleaner. Avoid using excessive amounts of liquid on the touch panel.

Cleaning the Optional Enclosure

Clean the optional plastic enclosure using a soft cloth slightly dampened with water or a non-abrasive household cleaner.

Cleaning the Optional Keyboard

Clean the optional keyboard using a soft cloth slightly dampened with water or a non-abrasive household cleaner.

PROBLEMS?

If the TCS fails to operate properly, first check all cables and connections. Make sure the power switch is on and that the line voltage selection switch is in the correct position. Make sure power is available at the wall outlet. If the TCS turns on, make sure it beeps. If it doesn't beep when it is powered-up, the unit requires service. If the TCS beeps, but there is no display, check the setting of the contrast control. (The contrast control may be turned down too far.)

If the display lights when the TCS is powered-up, it may be possible to locate the source of the problem by reading an error message on the screen. Error messages remain on the screen until the first user or host activity is detected. To troubleshoot the TCS more thoroughly, run the self-tests that are accessible from the Test Screen. Instructions for using the Test Screen follow.

TESTING THE TOUCH CONTROL SCREEN WITH THE TEST SCREEN

The Test Screen, which is accessible from the Setup Screen, is shown in Figure 14. The user can select six tests from the Test Screen:

- Touch Panel Integrity Test
- Display Geometry Test
- Display Intensity Test
- Standard Character Set Test
- Extended Character Set Test
- Keyboard Test

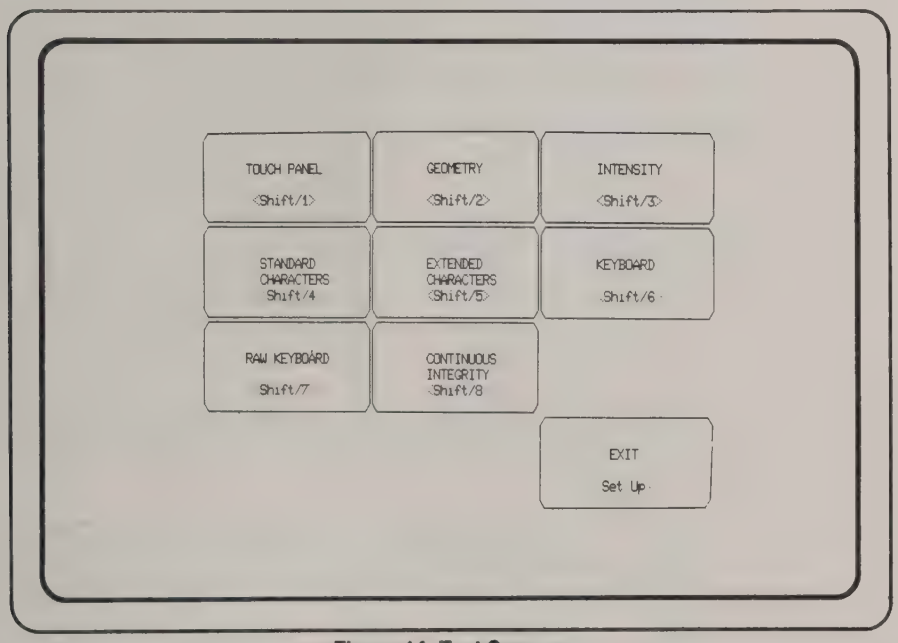


Figure 14. Test Screen

Two other tests are accessed from the Test Screen (the Raw Keyboard Test and the Continuous Integrity Test), but these are intended to be used only by service personnel.

Use the following procedure to call up and exit the Test Screen:

1. Call up the Setup Screen by pressing the rear panel SET UP switch (if accessible) or by pressing the Set Up key on the optional keyboard.

2. Call up the Test Screen by touching the TEST touchkey or by typing Shift/T on the keyboard.

3. To exit the Test Screen, touch the EXIT touchkey, press Set Up on the keyboard, or press the rear panel SET UP switch.

The Test Screen provides touchkey or keyboard activation of any of the user-selected tests available for the TCS. To begin a test, touch the appropriately labeled touchkey, or type the keyboard entry shown on the touchkey.

Once a user-selected test is started, the test may take over control of the display screen. The test remains active until the Set Up key on the keyboard or the SET UP switch on the rear panel is pressed. This returns the TCS to the Test Screen.

NOTE

When a test is activated, input from the host continues to be received, but is not processed. If the host continues to send data, the TCS automatically sends an XOFF to the host when the TCS input buffer fills up. This prevents the host from overflowing the TCS input buffer with data.

The TCS tests are described in the following paragraphs. If the TCS should fail any of these tests, contact your local service representative.

Touch Panel Integrity Test

The Touch Panel Integrity Test checks the touch cells for proper working condition. The display showing the Touch Panel Integrity test is shown in Figure 15. Use the following procedure to test the touch panel:

1. To begin the test, press the TOUCH PANEL touchkey on the Test Screen, or type Shift/1 on the optional keyboard. Each touchkey is identified on the screen by a three-digit key number.

2. Press each touchkey and make sure that it changes to reverse video to show that the touch cell works properly. If the touchkey is touched again, it reverts to normal video.

3. Press the touchkey positions along one row and one column in the touch cell matrix to quickly check the touch panel for opens, shorts, or decoding errors. This method quickly verifies that all rows and columns are operational.

4. To do a comprehensive touch panel test, press each touchkey to verify its operation.

5. To stop the test, press the Set Up key on the keyboard or the SET UP switch on the rear panel. This returns the TCS to the Test Screen.

Display Geometry Test

The Display Geometry Test allows the user to check the linearity and geometry of the display. To begin the test, press the GEOMETRY touchkey on the Test Screen, or type Shift/2 on the keyboard.

The Display Geometry Test provides a pattern that allows you to see how straight the lines and how square the corners of the display are. In a well-aligned display, lines are straight and uniform within the area provided for them on the display. The pattern of the Display Geometry Test is shown in Figure 16.

The test remains active until the Set Up key on the keyboard or the SET UP switch on the rear panel is pressed. This returns the TCS to the Test Screen.

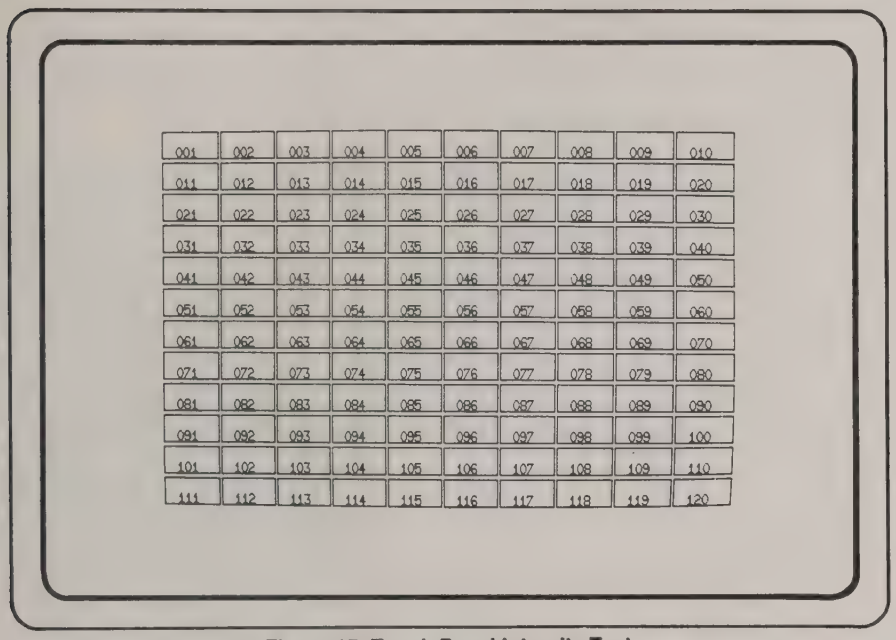


Figure 15. Touch Panel Integrity Test

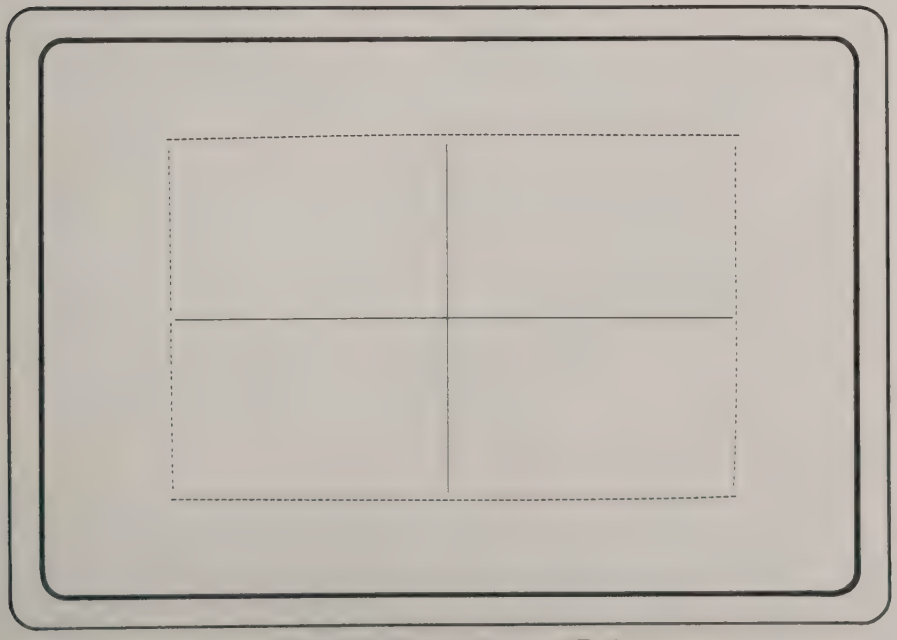


Figure 16. Display Geometry Test

Display Intensity Test

The Display Intensity Test allows the nominal intensity of the display to be measured. To begin the test, press the INTENSITY touchkey on the Test Screen, or type Shift/3 on the optional keyboard. This lights every pixel on the display at normal intensity.

The test remains active until the Set Up key on the keyboard or the SET UP switch on the rear panel is pressed. This returns the TCS to the Test Screen.

Standard Character Set Test

The Standard Character Set Test provides a detailed view of the Standard Character Set. To begin the test, press the STANDARD CHARACTERS touchkey on the Test Screen, or type Shift/4 on the optional keyboard. Each of the characters in the Standard Character Set (including those underlying control codes) is displayed in double size. The characters on the screen are arranged in a checkerboard pattern for easy recognition. The display showing the Standard Character Set is shown in Figure 17.

The test remains active until the Set Up key on the keyboard or the SET UP switch on the rear panel is pressed. This returns the TCS to the Test Screen.

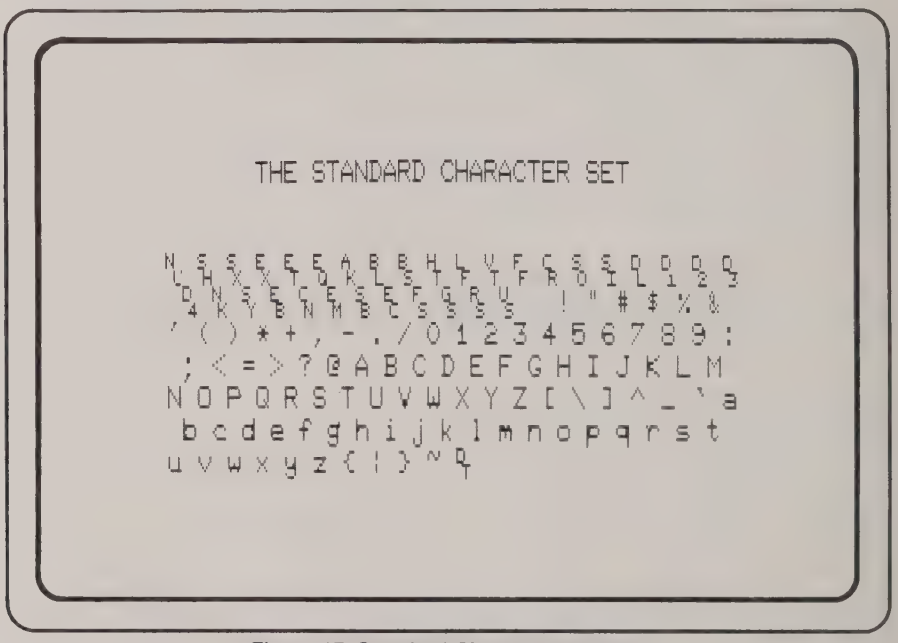


Figure 17. Standard Character Set Test

Extended Character Set Test

The Extended Character Set Test provides a detailed view of the Extended Character Set. To begin the test, press the EXTENDED CHARACTERS touchkey on the Test Screen, or type Shift/5 on the optional keyboard. Each of the characters in the Extended Character Set is displayed in double size, including characters that underlie control codes. The characters on the screen are arranged in a checkerboard pattern for easy recognition. The display showing the Extended Character Set is shown in Figure 18.

The test remains active until the Set Up key on the keyboard or the SET UP switch on the rear panel is pressed. This returns the TCS to the Test Screen.

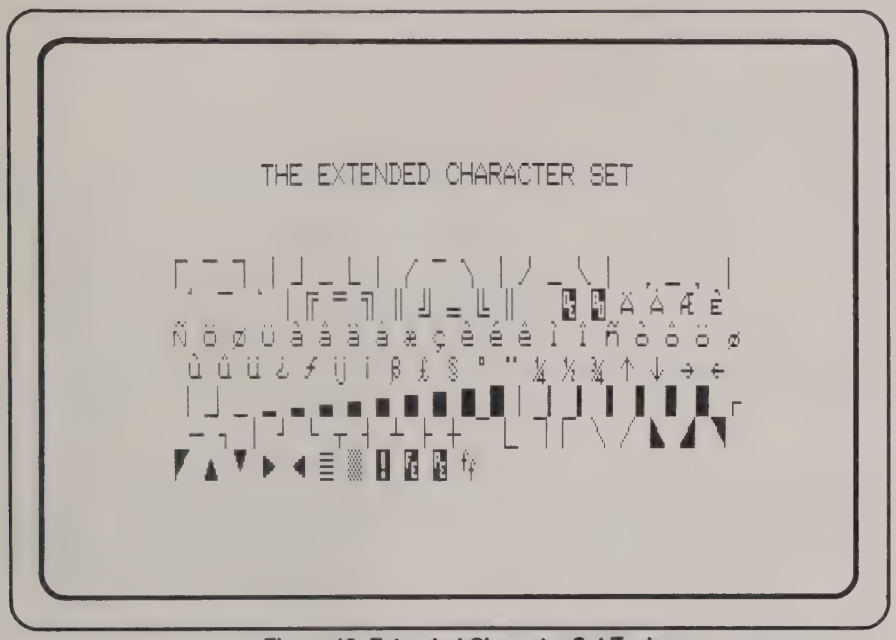


Figure 18. Extended Character Set Test

Keyboard Test

The Keyboard Test allows the user to verify proper operation of all keys on the optional keyboard. To begin the test, press the KEYBOARD touchkey on the Test Screen, or type Shift/6 on the keyboard. This calls up a picture of the keyboard (without the Set Up key) on the display. The outline of each key is initially lit in normal video. The display showing the Keyboard Test is shown in Figure 19.

To verify proper operation of all keys, press each key on the keyboard except the Set Up key. (The Set Up key is tested when it is pressed to exit the Keyboard Test.) When a key is pressed, the corresponding key on the display toggles from normal to reverse video. Continue until the entire keyboard is in reverse video. The characters on the Keyboard Test screen reflect the NRC setting currently selected. This test may be used to see which ASCII characters are replaced by the current NRC.

The test remains active until the Set Up key on the keyboard is pressed. This tests the Set Up key and returns the TCS to the Test Screen.

Raw Keyboard Test

The Raw Keyboard Test allows service personnel to test the raw key code for each key on the optional keyboard. (The raw key codes are unprocessed codes sent directly from the keyboard.) The Raw Keyboard Test is not intended to be run by the user. If the test is activated, it can be exited by pressing the Set Up key on the keyboard or the SET UP switch on the rear panel. This returns the TCS to the Test Screen.

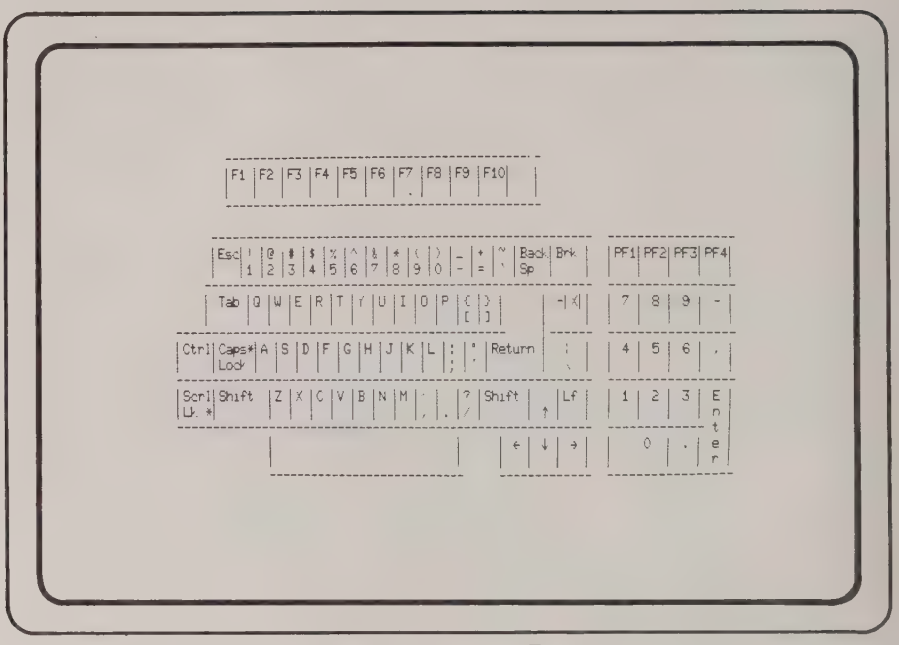

F1 F2 F3 F4 F5 F6 F7 F8 F9 F10
Esc ! 1 @ 2 # 3 $ 4 % 5 ^ 6 & 7 * 8 (9) 0 _ - + = ~ ` Back Sp Brk
PF1 PF2 PF3 PF4
Tab Q W E R T Y U I O P { [}] | \
7 8 9 -
Ctrl Caps Lock A S D F G H J K L : ; " ' Return
4 5 6 ,
Scrl Lk Shift Z X C V B N M < , > . ? / Shift
1 2 3 Ent er
Lf
0 .

Figure 19. Keyboard Test

Continuous Integrity Test

The Continuous Integrity Test allows the TCS to continuously test itself. This test is intended to be run by service personnel only. If the Continuous Integrity Test is activated, it can be exited by pressing the Set Up key on the keyboard or the SET UP switch on the rear panel. This returns the TCS to the Test Screen.

Glossary

address

A coded number representing the location of an item. Examples include bus address and program address.

Alignment Screen

Display screen used to realign the horizontal and vertical position of the display on the face of the CRT to match the overlying touch panel. The Alignment Screen is accessed from the Setup Screen.

ANSI

American National Standards Institute, Inc., a group that develops and publishes industry standards.

application software

A program running on a host computer designed to perform specified functions in a working environment.

ASCII

American Standard Code for Information Interchange as defined by ANSI document X3.4-1977. ASCII is a standardized code set for 128 characters, including full alphabetic (upper and lower case), numerics, punctuation, and a set of control characters.

asynchronous data

Information transmitted or received at random times with respect to a particular system. In terminals, asynchronous data usually consists of one character at a time, and at predefined, self-clocking baud rates. See also synchronous data.

baud rate

The serial transfer rate in bits per second including all framing bits used to identify the start and end of characters or messages.

binary

A number system based on zero (0) and one (1) representations, often used to represent data or instruction codes. In binary there are only two numbers, so digital computers can use binary for their operation because each number can be represented as the state (on or off) of a transistor.

bit

A contraction of binary digit. A bit is either a 1 or a 0 and represents the smallest single unit of computer information. Bits are often used in groups of seven or eight to represent characters.

boxtypes

Graphics characters used by the TCS to draw rectangular boxes on the screen. Boxtypes are used to create touchkeys.

break

A communication signal that can be recognized at any baud rate. The TCS generates a short break when the Break key on the optional keyboard is pressed, and a long break when Shift/Break is pressed. The TCS ignores any break it receives. See also short break and long break.

buffer

A storage location for information.

byte

A grouping of bits that represent a single character.

character cell

A portion of the display 8 pixels wide by 10 pixels high that is used to display a character. The TCS has 1920 character cells arranged in 24 lines of 80 characters.

character set

The character set includes the upper-case and lower-case alphabet, the ten numerals, punctuation, graphic characters, boxtypes, international characters, and control characters.

character string

A grouping of characters.

control character

A nonprintable character used to produce a specific action such as a carriage return or line feed, or halting and restarting scrolling.

control sequence

An ANSI X3.64-1977 or ANSI-compatible sequence of ASCII characters that produces a desired display effect such as cursor position or reverse video.

Control Sequence Introducer

Special characters that cause the characters following it to be interpreted as an ANSI-standard or ANSI-compatible control sequence.

CPU

Central processing unit, the controlling instruction and data processor in any computer system. In the TCS, the CPU is a 68008 microprocessor with its supporting components located on the logic board.

CRT

Cathode-ray tube, the display screen on the front of the TCS.

CTS

Clear to Send, a signal used in RS-232-C communication. The TCS will not transmit data if CTS is off (low).

cursor

The visible pointer on the CRT display that indicates to the user the position where the next character will appear.

data

Normally refers to information that has been collected for interpretation by a program.

DCE

Data communication equipment as described by the EIA Standard RS-232-C. Modems and null-modem cables are examples of DCE. As specified by RS-232-C, in order to make a communications link, DCE must be connected to data terminal equipment (DTE).

default value

The parameter value that is assumed when no explicit value, or sometimes a value of 0, is specified.

display

The area on the CRT that can display character cells.

DSR

Data Set Ready, a signal used in RS-232-C communication. The TCS does not transmit characters to the host unless the DSR signal is on (high).

DTE

Data terminal equipment as described by the EIA Standard RS-232-C. The TCS is an example of DTE. As specified by RS-232-C, in order to make a communications link, DTE must be connected to data communication equipment (DCE).

DTR

Data Terminal Ready, a signal used in RS-232-C communication. The TCS sets the DTR signal on (high) when it is ready to begin communication with the host. DTR is subsequently set off (low) only during a long break or reset.

EIA

Electronic Industries Association, publisher of standards RS-232-C and RS-422-A for binary serial data communication.

EPROM

Erasable Programmable Read Only Memory. A memory device that can be erased with ultraviolet light and reprogrammed using specialized equipment.

escape sequence

A string of ASCII characters beginning with the escape character ⟨ESC⟩. These strings generally convey special programming and control information between the host and the TCS when sent over the serial port. (This is also called a control sequence).

Extended Characters

Characters in the upper half (128 positions) of the 256-character set.

firmware

Computer programs and data that are recorded in permanent memory. See ROM.

handshaking

A method by which data is exchanged between devices only when each device has signaled that it is ready.

hard reset

A reset command executable only by the host computer that returns all the parameters of the TCS to their factory-programmed default values. The TCS then undergoes a normal power-up sequence.

hexadecimal

A number system based on 16 digits. Sometimes called hex, the system uses 0 through 9, and A, B, C, D, E, and F, to represent the digits above 9.

host

A separate product or system (usually a computer) that interacts with the TCS through the RS-232-C serial interface.

input buffer

The buffer within the TCS containing characters received from the host.

interface

A hardware and software connection of devices within a system.

LED

Light-emitting diode. Used as indicators on the Scroll Lock and Caps Lock keys on the optional keyboard. The LEDs are lit when the keys are locked and off when the keys are unlocked.

long break

A communication disruption sent by the TCS when the optional keyboard keys Shift/Break are pressed. A long break sets the DTR and RTS signals low for 3.5 seconds.

NEMA

National Electrical Manufactures Association. Publishers of various standards, including the NEMA 12 standard that describes dust-proof and water-resistant enclosures.

non-volatile memory

An electronic memory that retains its contents when power is turned off. The TCS uses non-volatile memory to store programmable characteristics of the TCS between operating sessions.

NRC

National Replacement Code. One of several standardized codes whereby some standard ASCII codes are displayed as characters particular to a given nationality's language.

mnemonic

From the technique used to help a person memorize information, an abbreviated name for something. Examples of mnemonics are "XON" and "XOFF", for "transmit-on" and "transmit-off".

output buffer

The buffer within the TCS containing characters to be sent to the host.

parallax

An optical effect that occurs when viewing two objects at different distances from different angles. For example, the distance from the surface of the touch panel to the image on the tube, when viewed from an angle, can cause the user to misread the location of a visual target relative to the touch panel. This is parallax error.

parameter

An adjustable operating feature. Examples of parameters of the TCS include baud rate, cursor type, and light or dark background.

parameter string

A set of values within a control string that defines exactly how the control string should be interpreted by the TCS.

parity

A method of error detection that uses one extra bit for each unit of information (such as a byte). The parity bit is set to 1 or 0 so that the total number of 1s in the byte, together with the parity bit, is even or odd.

pixel

Acronym for picture element; the smallest amount of visual information that the display is able to resolve; one dot.

port

A connection point used for data transfer. See interface.

power-up sequence

The sequence of events after power is applied until the TCS is ready to assume full functional operation under the command of the user and/or host.

program

Any meaningful sequence of computer instructions that causes a system to accomplish a task.

PROM

Programmable Read Only Memory, a memory device that can be programmed using specialized equipment.

protocol

A set of rules for exchange of information between systems or devices.

RAM

Random-access memory. Through common usage, the term has come to mean the high-speed volatile semiconductor memory that is normally used for system and user memory. It is memory, both readable and writeable, used to store and recall information.

raster

The scanning pattern of an electron beam on a CRT display. A raster display uses the same scan pattern all the time, forming images by turning the beam on and off at appropriate times.

RLSD

Received Line Signal Detect, a signal used in RS-232-C communication. The TCS ignores data when RLSD is off (low).

ROM

Read-only memory. A memory used for permanently recorded computer programs and data.

RS-232-C

A digital communication standard agreed upon by participating manufacturers of data communication equipment for the transfer of serial digital data between data communication equipment (DCE) and data terminal equipment (DTE). The TCS is a DTE device. The standard is published and maintained by the Electronic Industries Association (EIA).

RS-422-A

An Electronic Industries Association (EIA) data communication standard that specifies two balanced-voltage signal lines that are independent of signal ground for each data channel. With RS-422-A, two pairs of balanced lines carry the data as a differential signal. This offers longer distance and higher signaling rates for direct-connect use than RS-232-C.

RTS

Request to Send, a signal used in RS-232-C communication. The TCS sets RTS on (high) whenever it can support communication with the host.

serial data

Information transmitted one bit at a time at a predefined baud rate.

serial port

A physical connector for transmitting and receiving serial data. The TCS uses the industry standard D-type connector for an RS-232-C interface.

Setup Screen

Display screen used to change various TCS parameters, and used to call up the Test and Alignment Screens. The Setup Screen may be entered by pressing the Set Up key on the optional keyboard or the SET UP switch on the rear panel (if accessible).

short break

A communication disruption sent by the TCS when the Break key on the optional keyboard is pressed. A short break sets the Transmit Data (TD) signal low for 300 milliseconds. The host recognizes a short break regardless of its baud rate setting.

soft reset

A reset command executable by the user through the Setup Screen or the host via a remote command that returns all the parameter values of the TCS to the last saved configuration. The TCS then undergoes a normal power-up sequence.

software

Computer programs and data recorded and used on a medium that can be erased and rewritten by program command.

SRTS

Secondary Request to Send, a signal used in RS-232-C communication. The TCS sets this signal off (low) when it sends the XOFF character to the host, and it sets SRTS on (high; the normal state) when it sends the XON character.

Standard Characters

Characters in the lower half (128 positions) of the 256-character set.

synchronous data

Digital information transmitted in predetermined message block sizes with a clock signal to synchronize the receiver to the transmitter. See also asynchronous data.

system

An interconnection of instruments or other devices.

target

A visual image displayed on the screen, perceived by the user as a single box, icon, group of characters, or other graphic symbol. A target indicates a location for the user to touch the screen.

TCS

The Touch Control Screen; this product, consisting primarily of a display screen and touch panel.

Test Screen

Display screen used to perform user-initiated tests of the TCS. The Test Screen is accessed from the Setup Screen.

touch cell

An individual physical switch on the touch panel. The touch panel on the TCS has 120 touch cells arranged in 12 rows by 10 columns.

touchkey

A group of one or more touch cells in conjunction with a visual target that work together as a command entry point for the user. All touch cells in the group are defined by the programmer as a touchkey, so the program recognizes an input from any of the touch cells as the same entry.

touch panel

The transparent overlay residing in front of the display, that detects physical touch against areas of the display.

UART

Universal Asynchronous Receiver-Transmitter. An integrated circuit that performs serial transmission and reception of information over a communication link.

XOFF

"Transmit-off" character sent to signal that transmission of data should be stopped from a source to a destination. This character is an ASCII ⟨DC3⟩ (decimal 19, hex 13). The XOFF character is sent to the host when the user types Ctrl/S on the optional keyboard or when the input buffer is full.

XON

"Transmit-on" character sent to signal that transmission of data is allowed from a source to a destination. This character is an ASCII ⟨DC1⟩ (decimal 17, hex 11). The XON character is sent to the host when the user types Ctrl/Q on the optional keyboard or when the input buffer again has room.

Index

Aligning the display, 22
Arrow keys, see Cursor Control keys
Auto Wrap parameter, 22
Auxiliary Keypad, 29

Back Space key, 25
Background parameter, 15
Baud Rate parameter, 19
Beeper, 5
Break key, 25

Caps Lock key, 27
Caring for the Touch Control Screen, 29
Cleaning instructions, 29
  Cleaning the optional enclosure, 30
  Cleaning the optional keyboard, 30
  Cleaning the touch panel, 30
Connecting to the host, 5
  Direct-connect, 6
  Using modems, 6
Contrast control, 4
Controls, 4
  Beeper, 5
  Contrast control, 4
  Line Voltage Selection switch, 4
  Power switch, 4
  SET UP switch, 5
Ctrl key, 26
Cursor Control keys, 28
Cursor Type parameter, 16

Data Bits parameter, 19
Data flow, 3
  From the host to the Touch Control Screen, 3
  From the Touch Control Screen to the host, 3
Delete key, 25
Display Activity parameter, 16

Enclosure, optional, 1
Error messages, 13
Esc key, 28

Framing Error character, 20
Full-duplex communication, 5
Functional overview, 1

Glossary, 37

International characters, see NRC parameter

Key codes, 25
  Auxiliary Keypad codes, 30
  Ctrl key codes, 27
  Cursor Control key codes, 28
  Special Function key codes, 25
Keyboard, optional, 5
  Auxiliary Keypad, 29
  Cursor Control keys, 28
  Set Up key, 28
  Special Function keys, 28
  Standard keys, 25
  Using the optional keyboard, 24

Line Feed key, 25
Line Voltage Selection switch, 4
Line voltage, selecting, 8
Local Echo parameter, 21
Local/Remote parameter, 21

New Line parameter, 21, 22
Non-volatile Setup memory, 4, 15
NRC parameter, 16
Null-modem cable, 6

Optional configurations, 1
  Optional keyboard, 5
  Optional plastic enclosure, 1

Parallax error, 10
Parity checking, 19
Parity Enable parameter, 19
Parity Error character, 20

Parity Sense parameter, 19
Power switch, 4
Power-up sequence, 9
Problems?, 30

Refresh Rate parameter, 22
Return key, 21, 26
Scroll Lock key, 26
Selecting line voltage, 8
Self testing, 10
  RAM Integrity Test, 10
  ROM Checksum Test, 10
  Non-Volatile Setup Memory Test, 10
  Touch Panel Closure Test, 10
Set Up key, 28
SET UP switch, 5
Setup parameters, 10, 14, 15
  Descriptions of, 15
  How to change, 14
  How to save, 15
  Volatility of, 15
Setup Screen, 10
  Descriptions of the Setup parameters, 15
  Direct Action Area, 11
  How to call up and exit the Setup Screen, 14
  How to change Setup parameters, 14
  How to save Setup parameters, 15
  Major divisions of the Setup Screen, 11
  Operational Status Window, 13
  Parameter list area, 11
  Using the Setup Screen, 10
  Volatility of Setup parameters, 15
Shift key, 26
Space bar, 26
Special Function keys, 28
Standard keys, 25
Stop Bits parameter, 20

Tab key, 28
Testing the TCS with the Test Screen, 31
  Continuous Integrity Test, 36
  Display Geometry Test, 32
  Display Intensity Test, 34
  Extended Character Set Test, 34
  Keyboard Test, 35
  Raw Keyboard Test, 35
  Standard Character Set Test, 34
  Touch Panel Integrity Test, 32
Test Screen, 31
Touch panel, 4
Touching the touch panel, 10
Turning on the TCS, 9

1020 Series

TOUCH CONTROL SCREEN

Programmer's Guide

FLUKE

1020 Series

TOUCH CONTROL SCREEN

Programmer's Guide

P/N 778746
APRIL 1986 Rev. 1, 7/89
©1989 John Fluke Mfg. Co., Inc. All rights reserved. Litho in U.S.A.

FLUKE

Table of Contents

SECTION	TITLE	PAGE
1	**INTRODUCTION**	1-1
	Introduction	1-1
	Features	1-1
	Optional Configurations	1-2
	About the Programmer's Guide	1-4
	Other Manuals	1-5
	Functional Overview of the Touch Control Screen	1-6
	Data Flow From the TCS to the Host	1-6
	Data Flow From the Host to the TCS	1-6
	Non-Volatile Setup Memory	1-6
2	**INTERFACING WITH THE HOST COMPUTER**	2-1
	Introduction	2-1
	The Serial Interface	2-1
	Bit-Serial Data	2-1
	Transmitted Characters	2-1
	Timing Format	2-2
	Data Rate	2-2
	Character Composition	2-2
	Start Bit	2-3
	Stop Bit	2-3
	Parity Bit	2-3
	Communication Standards	2-4
	RS-232-C	2-5
	RS-232-C Signal Descriptions	2-6
	RS-422-A	2-8
	When Should RS-422-A Be Used?	2-8
	Preventing and Catching Errors	2-9
	Character Overflow Control	2-9
	Sending XOFF to the Host	2-10
	Sending XON to the Host	2-10
	Sending XOFF to the TCS	2-10
	Sending XON to the TCS	2-10
	Setting Communication Parameters	2-11

(continued on page ii)

SECTION	TITLE	PAGE
3	**PROGRAMMING OVERVIEW**	**3-1**
	Introduction	3-1
	Coding Standards	3-1
	Character Codes	3-2
	Communication Environments	3-2
	Character Sets	3-2
	Standard Character Set	3-2
	Extended Character Set	3-3
	Touch Control Screen Commands	3-4
	Types of Commands	3-4
	Local Commands	3-4
	Remote Commands	3-7
	Local/Remote Commands	3-8
	Control Strings	3-8
	Types of Control Strings	3-8
	Simple Escape Sequences	3-9
	Control Sequences	3-9
	Control Sequence Parameters	3-10
	How the TCS Interprets Control Sequences	3-12
	Cancelling Control Strings	3-12
	How to Generate Remote Commands	3-12
	Status Report Summary	3-13
	Summary of Status Queries and Responses	3-13
	Types of Status Queries and Responses	3-13
	Summary of Selectable Modes	3-16
	TCS Mode Commands	3-18
	Reset Mode Command [RM] (Remote)	3-19
	Set Mode Command [SM] (Remote)	3-20
4	**CONTROLLING THE SETUP SCREEN AND THE SERIAL INTERFACE**	**4-1**
	Introduction	4-1
	Overview of Functional Volatility	4-2
	Setup Screen Programming Considerations	4-4
	Keyboard Lockout	4-4
	Touch Panel Lockout	4-4
	Display Activity	4-4
	Display Contents	4-4
	Host Communication During Setup Session	4-5
	Methods of Changing Setup Parameters	4-5
	User/Host Conflict Resolution	4-6
	Permanence of Changes to Setup Parameters	4-6
	Setup Screen Commands	4-8
	Setup Lockout Mode Command {FSULM} (Remote)	4-9
	Save Setup Command {FSSU} (Local/Remote)	4-10
	Recall Setup Command {FRSU} (Local/Remote)	4-11
	Reset Command [RIS] (Local/Remote)	4-12
	Communication Commands	4-14
	Baud Rate Command (Local)	4-15
	Data Bits Command (Local)	4-16
	Parity Enable Command (Local)	4-17
	Parity Sense Command (Local)	4-18

(continued on page iii)

SECTION	TITLE	PAGE
	Stop Bits Command (Local)	4-19
	Local/Remote Mode Command (Local)	4-20
	Reporting Format Command {FRF} (Remote)	4-21
	Clear User Inputs Command {FCUI} (Remote)	4-23
5	**DISPLAYING CHARACTERS**	**5-1**
	Introduction	5-1
	Touch Control Screen Character Sets	5-1
	Standard Character Set	5-2
	Extended Character Set	5-2
	Character Displaying Commands	5-3
	Display Normal Characters Command (Remote)	5-4
	Display Double-Width Line Command (DECDWL) (Remote)	5-6
	Display Double-Size Line Command (DECDHL) (Remote)	5-7
	Display Normal Line Command (DECSWL) (Remote)	5-8
	Erase Character Command [ECH] (Remote)	5-9
	Erase in Line Command [EL] (Remote)	5-10
	Erase in Display Command [ED] (Remote)	5-12
	Character Interpretation Commands	5-14
	Auto Wrap-Around Mode Command (DECAWM) (Local/Remote)	5-15
	Send-Receive Mode Command [SRM] (Local/Remote)	5-16
	New Line Mode Command [LNM] (Local/Remote)	5-17
	Select Character Set Command [SCS] (Remote)	5-18
	NOCHANGE Attribute Mode Command {FNCAM} (Remote)	5-20
	National Replacement Code Command {FNRC} (Local/Remote)	5-23
	Set Character Attributes Command [SGR] (Remote)	5-28
	Scrolling Region Command (DECSTBM) (Remote)	5-30
	Origin Mode Command (DECOM) (Remote)	5-32
	Cursor Commands	5-34
	Move Cursor to Absolute Position Command [CUP] (Remote)	5-35
	Move Cursor Forward Command [CUF] (Remote)	5-37
	Move Cursor Backward Command [CUB] (Remote)	5-38
	Move Cursor Up Command [CUU] (Remote)	5-39
	Move Cursor Down Command [CUD] (Remote)	5-40
	Next Line Command [NEL] (Remote)	5-41
	Index Command [IND] (Remote)	5-42
	Reverse Index Command [RI] (Remote)	5-43
	Read Cursor Position Command [CPR] (Remote)	5-44
	Read Character Under Cursor Command {FRCUC} (Remote)	5-45
	Read Attributes Under Cursor Command {FRAUC} (Remote)	5-47
	Cursor Type Command {FCT} (Local/Remote)	5-49
	Screen Appearance Commands	5-51
	Screen Background Mode Command (DECSCNM) (Local/Remote)	5-52
	Display Activity Command {FDA} (Local/Remote)	5-53
	Horizontal Alignment {FHA} (Local/Remote)	5-55
	Vertical Alignment Command {FVA} (Local/Remote)	5-56
	Vertical Refresh Rate Command (Local)	5-57
6	**PROGRAMMING THE TOUCH PANEL**	**6-1**
	Introduction	6-1
	The Touch Panel	6-1

(continued on page iv)

SECTION	TITLE	PAGE
	Touch Cells	6-1
	Touchkeys and Touch Targets	6-2
	Touch Reporting	6-3
	Region Commands	6-5
	Erase a Region Command {FER} (Remote)	6-6
	Outline a Region Command {FOR} (Remote)	6-8
	Modify Character Attributes in a Region Command {FMCAIR} (Remote)	6-11
	Touch Panel Commands	6-13
	Polled Touch Mode Command {FPTM} (Remote)	6-14
	Read Touch Cell Status Command {FRTS} (Remote)	6-15
	Auto-Repeat Rate Command {FARR} (Remote)	6-16
	Touch Cell Audible Attribute Command {FTAA} (Remote)	6-18
	Touch Panel Lockout Mode Command {FTLM} (Remote)	6-20
7	**PROGRAMMING THE KEYBOARD**	**7-1**
	Introduction	7-1
	Keyboard Description	7-1
	Standard Keys	7-2
	The Set Up Key	7-4
	Cursor Control Keys	7-4
	Special Function Keys	7-6
	Auxiliary Keypad	7-7
	Keyboard Commands	7-8
	Keyboard Lockout Mode Command [KAM] (Remote)	7-9
	Keypad Mode Command (DECPAM) (DECPNM) (Remote)	7-10
	Local/Remote Mode Command (Local)	7-11
	Send Long Break Command (Local)	7-12
	Send Short Break Command (Local)	7-13
8	**REMOTE SELF-TESTING**	**8-1**
	Introduction	8-1
	Status Reporting Commands	8-2
	Power-Up Interrupt Mode Command {FPUIM} (Remote)	8-3
	Request Power Status Command {FRPS} (Remote)	8-4
	Request TCS Identification Command [DA] (Remote)	8-5
	Request TCS Status Command [DSR] (Remote)	8-6
	Remote Self-Test Commands	8-7
	Continuous Integrity Test Command {FCIT} (Local/Remote)	8-8
	Request ROM Test Report Command {FRRTR} (Remote)	8-11
	Request Non-Volatile Memory Test Report Command {FRETR} (Remote)	8-12
	Request RAM Test Report Command {FRRATR} (Remote)	8-13
	Request Touch Panel Test Report Command {FRTTR} (Remote)	8-15
9	**SAMPLE PROGRAMS**	**9-1**
	Introduction	9-1
	Sample Program Using the Fluke 1722A or 1752A	9-1
	Sample Program on the IBM PC or IBM XT (in BASICA)	9-4
	Sample Program on the IBM PC, IBM XT, or IBM AT (in BASIC)	9-4

(continued on page v)

SECTION	TITLE	PAGE
APPENDICES		
A	Glossary	A-1
B	Character Sets	B-1
C	RS-232-C and RS-422-A Pin Assignments	C-1
D	Command Lookup Tables	D-1
E	Touchkey Programming Worksheets	E-1
INDEX		

List of Tables

TABLE	TITLE	PAGE
2-1.	Framing Formats	2-3
2-2.	Touch Control Screen Parity Settings	2-4
2-3.	RS-232-C and RS-422-A Pin Assignments	2-5
3-1.	Control Characters Recognized by the TCS	3-3
3-2.	Summary of Touch Control Screen Commands	3-5
3-3.	Summary of Status Queries and Reports	3-14
3-4.	Summary of Selectable Modes	3-16
4-1.	Overview of Functional Volatility	4-2
4-2.	Control Over Individual Setup Parameters	4-5
5-1.	Effects of New Line Mode on Return and Enter Keys	5-17
5-2.	Effects of the New Line Mode on Cursor Movement	5-17
5-3.	Commands Affected by NOCHANGE Attribute Mode	5-21
5-4.	Commands Unaffected by NOCHANGE Attribute Mode	5-22
5-5.	National Replacement Code Characters	5-25
7-1.	Non-Alphanumeric Standard Key Codes	7-4
7-2.	Codes Sent by Keys When Pressed with the Ctrl Key	7-5
7-3.	Cursor Control Key Codes	7-5
7-4.	Special Function Key Codes	7-6
7-5.	Auxiliary Keypad Codes	7-7
9-1.	Sample Program Using the Fluke 1722A or 1752A	9-2
9-2.	Sample Program Using the IBM PC or IBM XT in BASICA	9-6

List of Illustrations

FIGURE	TITLE	PAGE
1-1.	Touch Control Screen with Enclosure and Keyboard	1-1
1-2.	Touch Control Screen	1-1
1-3.	Functional Block Diagram	1-7
2-1.	Typical Asynchronous Serial Character	2-3
6-1.	Touch Cell Number Assignments	6-2
6-2.	Example Touchkey and Touch Target	6-3
7-1.	The Optional Keyboard	7-1
9-1.	Null-Modem Cable	9-3

Section 1
Introduction

INTRODUCTION

The Touch Control Screen (TCS) is a sophisticated interface between human operators and computer-driven systems. The TCS allows the operator, with a minimum of training, to accurately and efficiently control even the most complex operations simply by touching the screen.

The Touch Control Screen interprets character strings from the host computer to create displays that provide the operator with information or ask the operator to select from the choices presented. The operator responds naturally by pointing to the appropriate choice and touching the display lightly. The TCS, acting as a software configured control panel, tells the computer that a particular area was touched.

The TCS is easy to integrate into any computer-based system, and is packaged to be easily mounted into a panel, in a rack, or on a table top. High-level software support facilitates the design of "touch targets"using only a few simple commands. The extreme reliability and durability of the TCS makes it appropriate for use in a variety of rugged environments.

FEATURES

The features of the TCS include:

- Touch panel consisting of a matrix of 120 touch cells (12 rows of 10 touch cells each).
- High-contrast CRT capable of displaying 1920 characters (24 lines of 80 characters each).
- User-selectable line attributes. Examples include normal, double width, and double size.
- User-selectable character attributes. Examples include highlight, underline, blink, and reverse video.
- Direct cursor addressing.
- Region commands which allow the programmer to outline and modify attributes within a rectangular region of the display.

- Programmable cursor type. Examples include non-blinking reverse block, slow-blinking reverse block, fast-blinking reverse block, non-blinking underline, slow-blinking underline, fast-blinking underline, and invisible.
- Large character set (256 characters).
- National Replacement Code method for the display of international characters.
- RS-232-C serial interface port with selectable baud rates in standard increments up to 19,200 baud.
- RS-422-A serial interface port for higher signalling rates at distances of up to 1200 meters (4000 ft).
- Rack mount and panel mount capability.
- NEMA 12 (National Electrical Manufacturers Association) water and dust resistance capability when panel mounted. (Requires the optional NEMA Mounting Kit.)
- Non-volatile memory for storing Setup parameters while the power is off.
- Test Screen for user-selected testing of the electronics, the display, and the touch panel.
- Alignment Screen for ensuring proper alignment between the display and the touch panel.
- Optional detachable keyboard.
- Custom Connector that provides access to selected internal signals on the logic board.
- Designed to comply with IEC 348, IEC 435, ANSI/UL 448, and CSA 556B safety standards.
- Verified to comply with FCC Class B and VDE 0871B EMI regulations.
- High resistance to shock and vibration.

OPTIONAL CONFIGURATIONS

The TCS is available with or without a keyboard and plastic enclosure. Because the built-in touch panel allows user input, not all TCS installations require the keyboard. Similarly, the enclosure is not required in installations where the TCS is mounted in a rack or panel. Figure 1-1 shows the basic TCS; Figure 1-2 shows the TCS with the optional enclosure and optional keyboard.

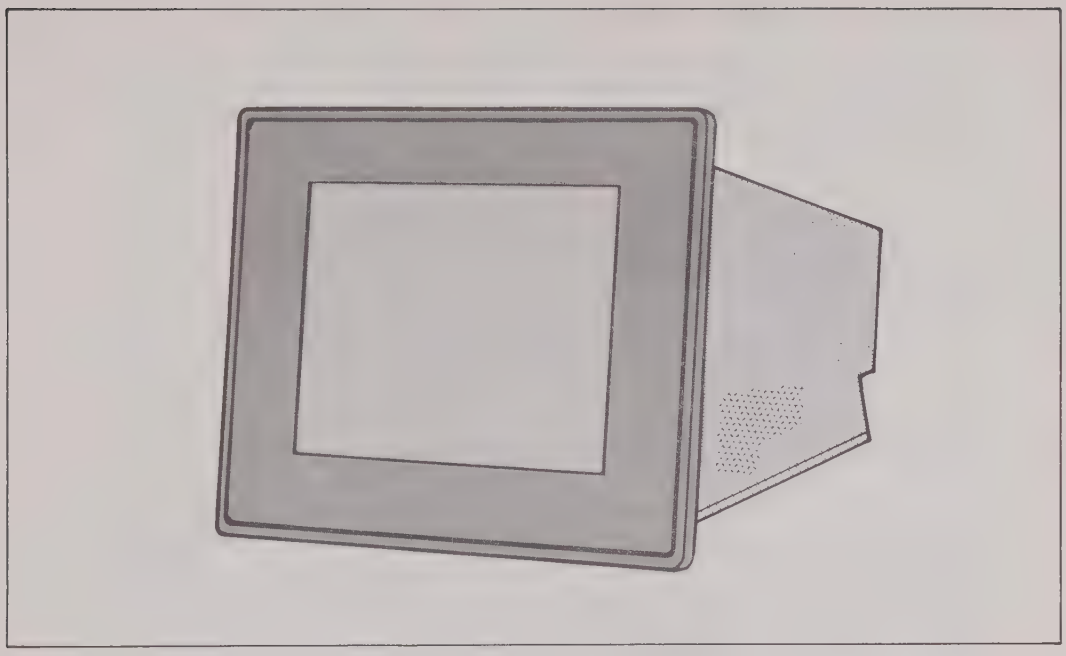


Figure 1-1. Touch Control Screen

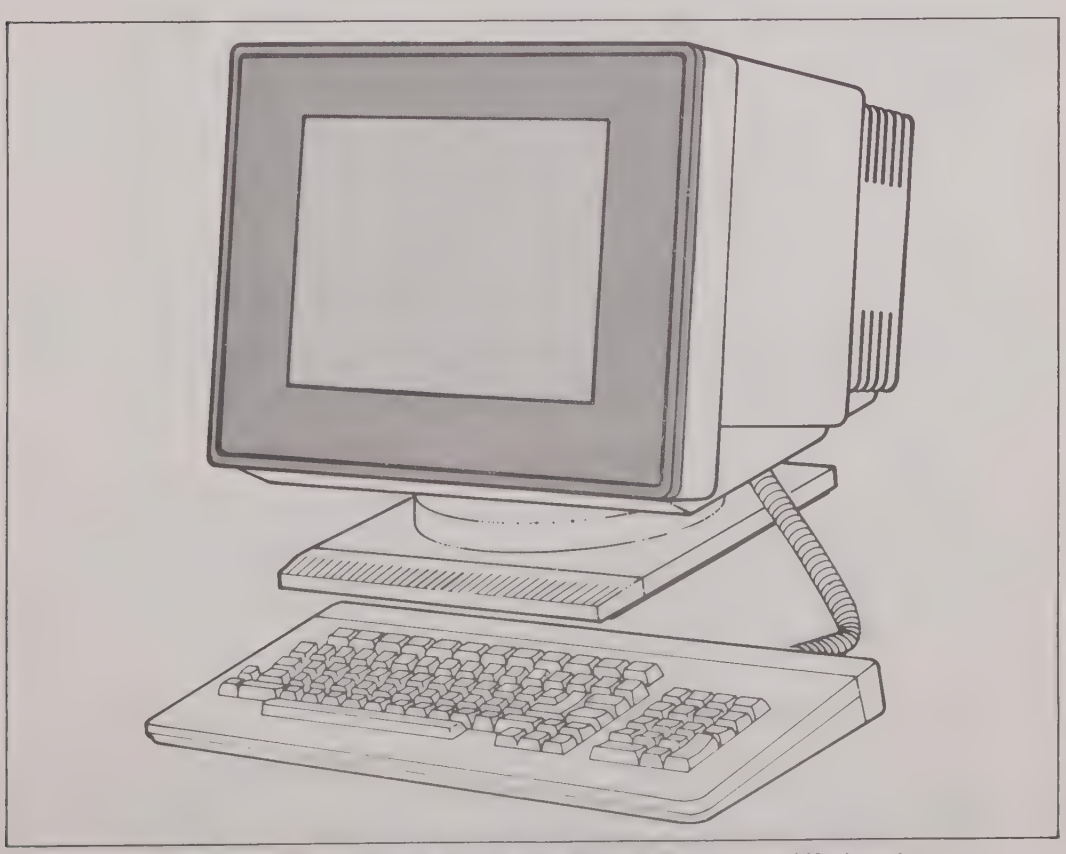


Figure 1-2. Touch Control Screen with Optional Enclosure and Keyboard

ABOUT THE PROGRAMMER'S GUIDE

The Programmer's Guide explains how to program the TCS to create the interface between the user and the host computer. It explains how to display characters, create touchkeys, and control and interpret the user's input from the touch panel and the optional keyboard.

The guide is organized as follows:

Section 1 Introduction

Section 1 introduces the TCS, describes the organization of this manual, and provides a functional overview of the TCS and its relation to the user and the host computer.

Section 2 Interfacing with the Host Computer

Section 2 provides background information about the serial interface between the TCS and the host computer. Topics include: serial data; EIA Standards RS-232-C and RS-422-A; TCS error checking methods; character overflow control; and a brief introduction to the communication parameters that can be programmed in the TCS. Readers experienced in programming computer terminals may want to skip this section and go directly to Section 3.

Section 3 Programming Overview

Section 3 provides a general introduction to the commands that control the TCS. Topics include: control characters and control strings; control string syntax; a summary of status reports the TCS can send the host; a summary of selectable modes; and detailed descriptions of the TCS Mode commands.

Section 4 Controlling the Setup Screen and the Serial Interface

Section 4 describes the commands that control the Setup Screen and the serial interface. Topics include: an overview of the volatility of TCS functions; Setup Screen programming considerations; and detailed descriptions of the Setup Screen commands and Communication commands.

Section 5 Displaying Characters

Section 5 explains how to display characters on the TCS. The section describes the available character sets and then describes in detail the commands used to display characters. The command descriptions are organized into four functional groups: Character Displaying commands, Character Interpretation commands, Screen Appearance commands, and Cursor commands.

Section 6 Programming the Touch Panel

Section 6 explains how to program the touch panel, including how to display touch targets and create touchkeys. Topics include: touch cells; touch targets; touchkeys; and TCS responses to touch cell closures. Detailed descriptions are provided for the Region commands and Touch Panel commands.

Section 7 Programming the Keyboard

Section 7 describes how to program the optional keyboard. Topics include: a description of the keyboard; codes transmitted by the keyboard; and detailed descriptions of all TCS programming commands relating to the keyboard.

Section 8 Remote Self-Testing

Section 8 explains how to use remote commands to determine the operational status of the TCS and activate self-tests built into the TCS.

Section 9 Sample Programs

Section 9 contains sample programs that illustrate how to design touchkeys on the TCS.

Appendix A Glossary

The glossary defines the technical terms and nomenclature that are commonly used in the vocabulary of programmable terminals and the TCS.

Appendix B Character Sets

Appendix B lists in table format the standard character set (the ASCII characters) and the extended character set. Each character's octal, decimal, and hexadecimal value is shown.

Appendix C RS-232-C and RS-422-A Pin Assignments

Appendix C illustrates the pin assignments of the rear panel RS-232-C connector.

Appendix D Programming Command Lookup Tables

Appendix D provides a quick, tabular reference to the command descriptions in the Programmer's Guide. Commands are listed alphabetically by name, alphabetically by mnemonic, and by functional group. Page numbers identify the appropriate text in this manual.

Appendix E Touchkey Programming Worksheets

Appendix E provides reproducible worksheets to help the programmer design the control interface. The worksheets represent the touch-cell grid.

Index

A comprehensive index is included at the back of this manual.

OTHER MANUALS

The User's Guide provides basic information about the TCS, including information about the Setup and Test Screens. It is recommended that the programmer read the User's Guide before reading the Programmer's Guide.

The Programmer's Quick Reference Guide provides fast access to TCS programming commands and other useful reference information. The guide includes command summaries organized both alphabetically and by function.

FUNCTIONAL OVERVIEW OF THE TOUCH CONTROL SCREEN

The following paragraphs provide a functional overview of the TCS and its relation to the user and the host computer. A functional block diagram of the TCS is shown in Figure 1-3.

Data Flow From the TCS to the Host

The user sends information to the host computer by touching touch cells on the surface of the touch panel or by pressing keys on the optional keyboard. Data is transmitted from the TCS through an output buffer. The output buffer can be controlled by the host to prevent the TCS from transmitting characters faster than the host can process them.

Data Flow From the Host to the TCS

Data sent from the host computer enters the input buffer where it is stored until the TCS can read it. The TCS processes the data from the input buffer and responds appropriately to control strings it encounters in the data stream. Printable characters are displayed on the CRT display. When the input buffer fills, the TCS sends a message to the host to halt transmission. When there is again room in the input buffer, the TCS signals to the host to resume transmission. This prevents the host from transmitting characters faster than they can be processed.

Non-Volatile Setup Memory

The TCS has a non-volatile memory for storing Setup parameters. This feature allows the user to configure the TCS as desired and store Setup parameters for recall on the next power-up. The TCS always keeps the factory-default Setup parameter values in a separate memory. The factory-default values are only recalled on a hard reset, which is a command that can only be sent by the host computer.

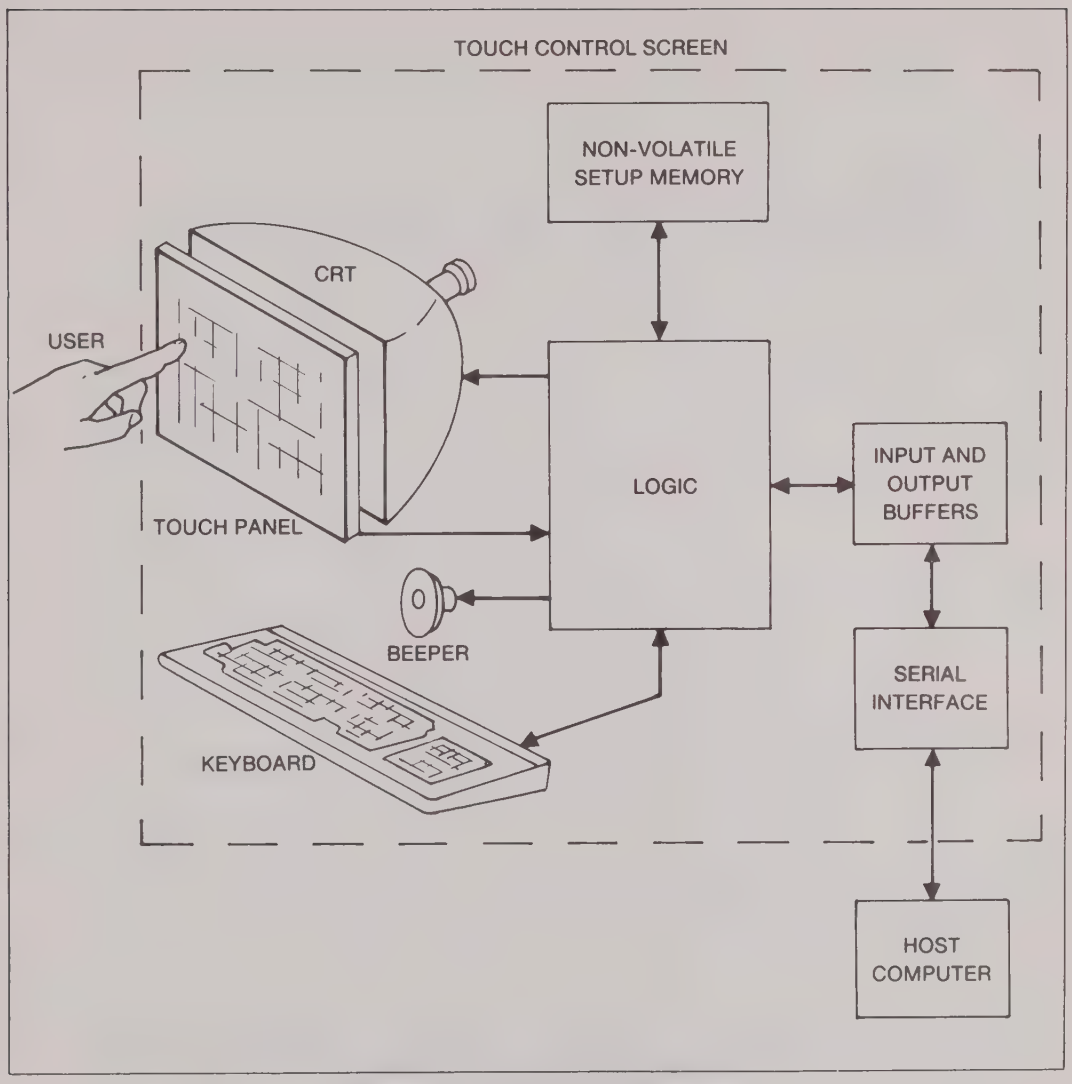


Figure 1-3. Functional Block Diagram

Section 2
Interfacing with the Host Computer

INTRODUCTION

This section provides background information about the communication between the Touch Control Screen (TCS) and the host computer. Topics include:

- A description of serial data
- Electronic Industries Association (EIA) Standards RS-232-C and RS-422-A
- TCS error checking methods, including XON/XOFF protocol
- A summary of TCS communication parameters that can be set by the user

Readers experienced in programming computer terminals may want to skip this section and go directly to Section 3.

THE SERIAL INTERFACE

The TCS communicates with the host computer via a serial interface. Information is exchanged as a series of characters represented in the form of bit-serial data.

Bit-Serial Data

Bit-serial data is digital information represented as a series of bits sent over a wire, one bit at a time. For each bit, the wire's voltage is either high or low, representing a one or a zero.

Transmitted Characters

Bits are sent between the TCS and host in groups of seven or eight bits, called data bits. (The data bits are sometimes preceded and followed by a few other bits, which are described later in this section.) Each group of data bits represents one character. The TCS recognizes 256 character codes from the host.

The TCS has a set of displayable characters that correspond to the character codes that can be received from the host. The characters are divided into two sets. The Standard Character Set corresponds to the lower 128 character codes; the Extended Character Set corresponds to the upper 128 character codes. Both character sets are illustrated in Appendix B.

The Standard Character Set consists of the 128-character set defined by the American Standard Code for Information Interchange (ASCII). ASCII is a

widely-accepted code set for representing characters in digital form. The ASCII code is used to represent printable characters (including upper and lowercase case letters, numbers, and common symbols) and non-printable control characters. When eight data bits are used, the Standard Characters are represented by the codes 00000000 through 01111111, binary (0 through 127, decimal; 0 through 7F, hex).

The Extended Character Set provides an additional 128 characters. These include international characters, graphics characters, boxtypes, and error codes. When eight data bits are used, the Extended Characters are represented by the codes 10000000 through 11111111, binary (128 through 255, decimal; 80 through FF, hex).

When only seven data bits are used to represent characters, the host sends the ASCII control characters ⟨SO⟩ (Shift Out) and ⟨SI⟩ (Shift In) to identify which set subsequent characters belong to, since seven data bits can directly represent only 128 characters.

The Standard and Extended Character Sets are illustrated in Appendix B. For more information about characters, including how to use ⟨SO⟩ and ⟨SI⟩, see Section 5.

Timing Format

Serial data can be transmitted in either a synchronous or asynchronous timing format. In a synchronous format, individual characters in the message are synchronized to a clock signal and sent one after another, without any special bits separating them. Start and stop characters mark the beginning and end of each message block, but start and stop bits are not sent with each character.

In an asynchronous format, data is not synchronized to a clock. Instead, start and stop bits mark the beginning and end of each character. Asynchronous formats have the advantage that the sender and receiver do not need to be synchronized with each other. The TCS operates exclusively using an asynchronous format.

Data Rate

Serial data speed is expressed in bits per second, or baud. Although baud technically means the number of state changes per second (which is not always equal to bits per second), the term baud rate is usually used interchangeably with bit rate. The TCS can send and receive data at all of the following bit rates: 110, 300, 600, 1200, 2400, 4800, 9600, and 19200 baud.

The TCS always sends and receives data at the same rate. For example, the TCS cannot be set to transmit data at 9600 baud and receive data at 1200 baud.

The baud rate is selected by the user through the Setup Screen. Instructions for selecting the baud rate are provided in the User's Guide, under the heading, Using the Setup Screen.

CHARACTER COMPOSITION

Each character sent between the TCS and the host begins with one start bit (always low), followed by seven or eight data bits (representing a character), an optional parity bit, and finally one or two stop bits (always high).

The combination of all the character's bits is called the character's framing format. Table 2-1 shows all framing formats supported by the TCS. Figure 2-1 shows the framing format for a typical asynchronous serial character with seven data bits, a parity bit, and two stop bits.

Table 2-1. Framing Formats

Start Bit	+ 7 Data Bits	+	+ 1 Stop Bit	= 9 Bits Total
Start Bit	+ 7 Data Bits	+ Parity Bit	+ 1 Stop Bit	= 10 Bits Total
Start Bit	+ 7 Data Bits	+	+ 2 Stop Bits	= 10 Bits Total
Start Bit	+ 8 Data Bits	+	+ 1 Stop Bit	= 10 Bits Total
Start Bit	+ 8 Data Bits	+	+ 2 Stop Bits	= 11 Bits Total
Start Bit	+ 7 Data Bits	+ Parity Bit	+ 2 Stop Bits	= 11 Bits Total
Start Bit	+ 8 Data Bits	+ Parity Bit	+ 1 Stop Bit	= 11 Bits Total
Start Bit	+ 8 Data Bits	+ Parity Bit	+ 2 Stop Bits	= 12 Bits Total

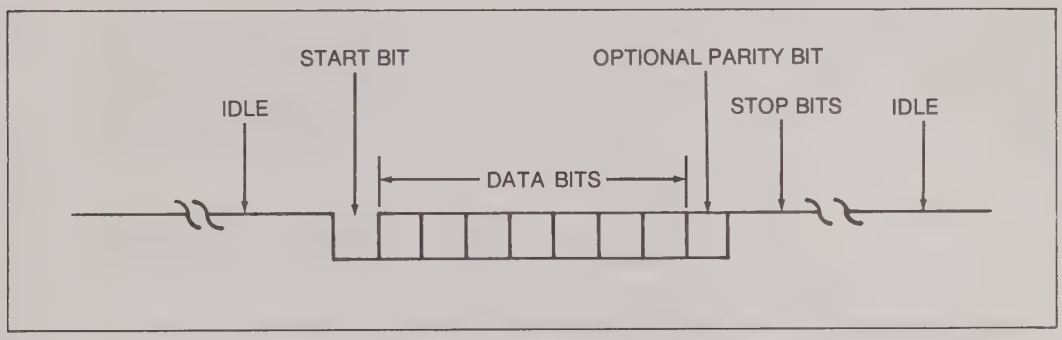


Figure 2-1. Typical Asynchronous Serial Character

Start Bit

The start bit tells the receiving station that the next seven bits (or eight, depending how the Data Bits parameter is set) represent an ASCII-coded character (or an Extended Character, if eight data bits are used), transmitted with the least significant bit first. The start bit is always a single low bit (representing zero).

Stop Bit

The stop bit tells the receiving station that it has received the end of the character. The stop bit is always high, which is the idle state of the line. A stop bit may be immediately followed by the start bit of another character, or it may just return the line to its idle state. (The latter case, for example, occurs when the stop bit belongs to the last character to be transmitted.)

To meet the requirements of various host computers and interfaces, the TCS can use either one or two stop bits. The number of stop bits is selected by the user through the Setup Screen. Instructions for selecting the number of stop bits are provided in the User's Guide, under the heading, Using the Setup Screen.

Parity Bit

The parity bit follows the seven or eight data bits. The parity bit is used to check for transmission errors. Parity checking can use either even or odd parity.

Even parity means that the parity bit and the data bits together contain an even number of binary 1s. For example, for the data bits 1010100, the parity bit is 1, making the total number of 1s even (in this example there are a total of four 1s).

Odd parity means that the parity and the data bits together contain an odd number of ones. For example, for the data bits 1010100, the parity bit is 0, making the total number of 1s odd (in this example there are total of three 1s).

By setting two TCS parameters (Parity Enable and Parity Sense), the parity bit can used in five different ways, as shown in Table 2-2. Instructions for setting the Parity Enable and Parity Sense parameters are provided in the User's Guide, under the heading, Using the Setup Screen.

Table 2-2. Touch Control Screen Parity Settings

PARITY ENABLE SETTING	PARITY SENSE SETTING	EFFECT
Off	Even or odd	Parity checking and generation are disabled. The TCS does not transmit a parity bit and does not expect parity bits in the data it receives. A received character containing a parity bit is displayed as a framing error (F_E).
On	Even	Parity checking and generation are enabled. The TCS transmits even-parity data by appending a parity bit and expects received data to have even parity. If the TCS receives data that has odd parity, the data is displayed as a parity error (P_E).
On	Odd	Parity checking and generation are enabled. The TCS transmits odd-parity data by appending a parity bit and expects received data to have odd parity. If the TCS receives data that has even parity, the data is displayed as a parity error (P_E).
Ignore	Even	Parity checking is disabled, but even parity generation is enabled. The TCS transmits even-parity data by appending a parity bit and expects received data to have a parity bit. However, the TCS does not check the parity of the received data.
Ignore	Odd	Parity checking is disabled, but odd parity generation is enabled. The TCS transmits odd-parity data by appending a parity bit and expects received data to have a parity bit. However, the TCS does not check the parity of the received data.

COMMUNICATION STANDARDS

The TCS adheres to two widely-used standards for serial communication: RS-232-C and RS-422-A. RS-232-C uses a single high-low data line that is referenced to signal ground. RS-422-A uses two balanced-voltage signal lines that are independent of signal ground for each data channel.

The RS-232-C standard describes signal types, signal levels, and the control signals that establish communication between devices (in this case, the host and the TCS).

The RS-422-A standard is a subset of RS-232-C in that it only describes signal types and signal levels.

The RS-232-C and RS-422-A interfaces both attach to the same connector on the TCS: a 25-pin, D-series, male connector. Pin assignments for this connector and names of the respective circuit names are listed in Table 2-3. The connector is illustrated in Appendix C.

The following paragraphs describe the RS-232-C and RS-422-A interfaces in more detail.

Table 2-3. RS-232-C and RS-422-A Pin Assignments

PIN	CIRCUIT	I/O	DESCRIPTION
1	AA	—	Protective Ground
2	BA	OUT	Transmitted Data
3	BB	IN	Received Data
4	CA	OUT	Request To Send
5	CB	IN	Clear To Send
6	CC	IN	Data Set Ready
7	AB	—	Signal Ground
8	CF	IN	Received Line Signal Detector
9	—	OUT	Balanced Transmit Data + (RS-422-A)
10	—	OUT	Balanced Transmit Data – (RS-422-A)
11	—	OUT	Secondary Request To Send
12	—	—	No Connection
13	—	—	No Connection
14	—	IN	Balanced Receive Data + (RS-422-A)
15	—	IN	Balanced Receive Data – (RS-422-A)
16	—	—	No Connection
17	—	—	No Connection
18	—	—	No Connection
19	SCA	OUT	Secondary Request To Send
20	CD	OUT	Data Terminal Ready
21	—	—	No Connection
22	—	—	No Connection
23	—	—	No Connection
24	—	—	No Connection
25	—	—	No Connection

RS-232-C

First established in 1969 and later revised, Electronic Industries Association (EIA) Standard RS-232-C defines the electrical and mechanical characteristics of an "interface between data terminal equipment and data communication equipment employing serial binary data interchange." RS-232-C is the most widely accepted standard for digital data communication; few pieces of computer-related equipment are supplied without an RS-232-C port.

The RS-232-C standard assigns functions to the circuit on each pin of the RS-232-C connector. Signal voltage level and timing requirements are prescribed by the standard, but character format, baud rate, and the use of parity bits in

RS-232-C-compatible devices can vary. The RS-232-C standard also assigns gender to individual connectors: the RS-232-C connector is female on DCE (Data Communication Equipment) and male on DTE (Data Terminal Equipment).

NOTE

The TCS is data terminal equipment (DTE) as described by the RS-232-C standard. As a DTE unit, the TCS is connected to data communication equipment (DCE), such as a modem. Connection to another DTE unit requires the use of a null-modem cable.

RS-232-C Signal Descriptions

RS-232-C was originally designed as a computer interface for use over telephone lines. Because of this, signals have names like RLSD (Received Line Signal Detector). The line referred to is the telephone line. Since the introduction of the standard, more ways of using RS-232-C have been developed. For example, instead of using telephone lines, a specially wired cable called a null-modem cable can be used to directly link two DTE units, such as the TCS and a host computer. The DTE units at each end of the null-modem cable interpret the cable as two modems communicating over telephone lines.

RS-232-C signals used by the TCS are described below. It is not necessary to understand each of these signals to program the TCS; this information is provided to help interface the TCS with different types of data communication equipment. The circuit designations defined in RS-232-C are given in parentheses after each signal name, (e.g., AA).

NOTE

When an RS-232-C control signal is on, its voltage is +3V to +25V. When the control signal is off, its voltage is -3V to -25V. When an RS-232-C data transmit and receive signal is in mark (one) condition, its voltage is -3V to -25V. When the data signal is in space (zero) condition, its voltage is +3V to +25V.

- Protective Ground (AA)

  Protective Ground is the common chassis ground of the TCS.

- Signal Ground (AB)

  Signal Ground is the common reference for the data and control lines.

- Transmitted Data (BA) (Output)

  Transmitted Data carries the stream of data bits generated by the TCS and sent to the DCE.

- Received Data (BB) (Input)

  Received Data carries the stream of data bits generated by the DCE and received by the TCS.

- Request to Send (CA) (Output)

  In the TCS, Request to Send (RTS) is always on immediately after the power-up sequence and self-tests have finished executing. RTS remains on except during a reset, a long break, or if the power to the TCS is switched off.

NOTE

This use of Request to Send complies with the RS-232-C standard, but precludes operating the TCS in half-duplex mode.

- Clear to Send (CB) (Input)

  The TCS polls Clear to Send (CTS) each time a character is due to be transmitted to the DCE over the serial link. If CTS is off, the character is not sent. When the DCE switches CTS off, transmission from the TCS halts on the next character boundary.

  Normally, the standard does not allow the DCE to switch CTS high or low at random. However, this technique is commonly used to allow the DCE to halt transmission from the TCS via a hardware signal. Allowing switched operation of CTS to halt transmission is compatible with operation as described by the RS-449 standard.

- Data Set Ready (CC) (Input)

  Data Set Ready (DSR) is set on by the DCE when ready for operation. The TCS polls DSR before every character transmission to the DCE. If DSR is off, the character is not sent to the DCE.

- Data Terminal Ready (CD) (Output)

  Data Terminal Ready (DTR) is switched on by the TCS as soon as the power-up sequence and self-tests are concluded. DTR remains on at all times, except during a reset or long break. DTR is switched off for the duration of the reset or long break signal and is reasserted "on" following the break regardless of the state of DSR.

  The RS-232-C standard specifies that once DTR is switched off by the terminal, DTR may not be driven on again until Data Set Ready from the DCE is switched off. Since the TCS supports a minimal three-wire RS-232-C interface where unconnected control circuits such as DSR are biased on, the operation of DTR is independent of DSR.

- Received Line Signal Detector (CF) (Input)

  Received Line Signal Detector (RLSD) is switched on by the DCE whenever the DCE detects a suitable primary carrier in the receive state. The primary carrier is the telephone line connection, or if a null-modem cable is used, the proper hard-wired connection. RLSD allows one station to determine whether the station at the other end has valid contact. If RLSD is off, the Received Data line is ignored by the TCS.

- Secondary Request to Send (SCA) (Output)

  Secondary Request to Send (SRTS) is switched off by the TCS whenever the TCS sends an XOFF (transmission off) to the DCE. SRTS is switched on by the TCS whenever it sends an XON (transmission on) to the DCE. The SRTS line may be used by the TCS to halt transmission from the DCE. For more information about XON/XOFF, see the heading, Host Interface XON/XOFF Control, later in this section.

RS-422-A

The RS-422-A standard defines an alternative communication method to RS-232-C. Both communication methods share the same connector on the TCS. RS-422-A offers longer distances than RS-232-C. The TCS supports both the RS-232-C and RS-422-A standards. The TCS will also communicate with equipment with an RS-485 interface. The RS-485 standard interface operates the same as RS-422-A, but with some additional capability, including multidrop. The TCS does not support the multidrop function of RS-485.

Unlike RS-232-C, RS-422-A uses a pair of balanced lines to carry each data channel. With RS-232-C, transmitted and received data are each carried on a single data line that is referenced to signal ground. With RS-422-A, transmitted and received data are each carried on a pair of balanced-voltage data lines that are independent of signal ground; the balanced lines carry the data as a differential signal.

RS-422-A can be used with RS-232-C control signals, or XON/XOFF protocol. XON/XOFF protocol is described later in this section, under the heading, Character Overflow Control.

When using RS-422-A, the balanced data lines are connected to pins 9, 10, 14, and 15. (Connector pin assignments are shown in Table 2-3.) In this case, the RS-232-C data lines Transmitted Data (pin 2) and Received Data (pin 3) are not used, and pin 3 must be left disconnected.

When Should RS-422-A Be Used?

RS-422-A should be used when any of the following conditions exists:

- The interconnecting cable is too long for effective unbalanced operation. RS-232-C suggests a limit of 15 meters (50 feet) between stations. Using RS-422-A, that distance can be up to 1200 meters (4000 feet).
- The interconnecting cable is exposed to excessive extraneous electrical noise sources. The RS-422-A standard has higher noise immunity than RS-232-C.
- Interference with other signals must be minimized.
- The signals must be inverted. (The signals can be inverted simply by reversing the leads at one end of each pair of data lines.)
- Ground loop problems exist.

communication errors. In particular, to maintain communication integrity, the TCS monitors and reports the following types of errors:

- Framing Error

  A Framing Error occurs when a character is received without a stop bit. When a framing error occurs, the single mnemonic character $^{F}_{E}$ is displayed in place of the character in error.

- Buffer Overflow

  A Buffer Overflow Error occurs when one or more characters have overflowed the TCS input buffer and been lost. When a buffer overflow error occurs, the single mnemonic character $^{B}_{O}$ is displayed on the screen instead of the characters that were lost.

- Overrun Error

  An Overrun Error occurs when a received character is overwritten by the next character before it can be read from the UART (Universal Asynchronous Receiver/Transmitter) in the TCS. When an overrun error occurs, the single mnemonic character $^{O}_{E}$ is displayed in place of the character that was overrun. The character that overran the previous character is interpreted normally.

- Parity Error

  A Parity Error occurs when a character is received with incorrect parity. When a parity error occurs, the single mnemonic character $^{P}_{E}$ is displayed in place of the character in error. (The TCS checks for parity errors only when the user has enabled parity checking; see the heading, Parity Bit, earlier in this section.)

CHARACTER OVERFLOW CONTROL

In addition to monitoring errors as described above, the TCS uses XON/XOFF protocol to prevent the input buffer in the host or TCS from overflowing. In XON/XOFF protocol, the TCS and the host turn the flow of serial data on and off by sending the characters XON (17 decimal, 11 hex) and XOFF (19 decimal, 13 hex).

To prevent its own input buffer from overflowing, the TCS sends an XOFF character to the host to request that the host stop sending data. When the TCS is ready to accept more data, the TCS sends an XON character to the host to request that the host resume sending data.

Similarly, to prevent the host's input buffer from overflowing, the TCS halts its flow of data to the host when the TCS receives an XOFF character from the host. The TCS resumes sending data to the host when the TCS receives an XON character from the host.

The following paragraphs describe in more detail how the TCS uses and interprets XON and XOFF.

Sending XOFF To the Host

The TCS gives the host two chances to avoid overflowing the TCS input buffer: first when the input buffer is 75% full, and again when overflow begins to occur. In

Sending XOFF To the Host

The TCS gives the host two chances to avoid overflowing the TCS input buffer: first when the input buffer is 75% full, and again when overflow begins to occur. In particular, the TCS sends an XOFF to the host (and switches the SRTS line off) when either of the following conditions exists:

- The TCS input buffer is 75% full (contains 96 characters), and the next character received is not XON or XOFF. This is the "first warning."

- The TCS input buffer is 100% full (contains 128 characters), the buffer has not yet overflowed, and the next character is not an XON or XOFF. This is the "second warning". The additional character overflows the buffer and causes the TCS to send an XOFF. The TCS drops the additional character and ignores any subsequent characters until the input buffer has room for more input.

The user can cause the TCS to send an XOFF to the host by pressing keys on the optional keyboard. In particular, the TCS sends an XOFF to the host (and switches the SRTS line low) when Ctrl/S is pressed (by holding down the Ctrl key while typing S).

Sending XON to the Host

The TCS sends an XON character to the host (and switches the SRTS line on) when any of the following conditions exists:

- The input buffer is emptied by the TCS, and the previous hold-off character sent to the host was XOFF.

- A Reset command has been completed, and the TCS is ready to receive input from the host.

- Ctrl/Q is pressed (by holding down Ctrl while typing Q).

Sending XOFF to the TCS

After receiving XOFF, the TCS ceases all transmission to the host on the next character boundary.

Sending XON to the TCS

After receiving XON, the TCS resumes transmission to the host.

NOTE

XON and XOFF are not treated like any other characters received by the TCS. Since XON and XOFF only control the communication flow between the TCS and the host, the TCS can legitimately handle XON and XOFF even when the TCS input buffer is full.

SETTING COMMUNICATION PARAMETERS

For the TCS and the host to communicate over the RS-232-A or RS-422-A interface, the configuration of the TCS serial interface must match the requirements of the host computer. As mentioned throughout this section, the user can configure the TCS serial interface by setting the following communication parameters:

- Baud Rate
- Parity Sense
- Parity Enable
- Number of Data Bits
- Number of Stop Bits

The communication parameters cannot be set remotely by the host. This prevents the host from accidentally disrupting communication by setting a parameter incorrectly.

Instructions for setting these parameters are provided in the User's Guide, under the heading, Using the Setup Screen. Additional information is also presented in Section 4 of the Programmer's Guide, under the heading, Communication Commands.

Section 3
Programming Overview

INTRODUCTION

This section provides a general overview of Touch Control Screen (TCS) programming. Topics include:

- Coding standards
- Character codes and character sets
- Touch Control Screen commands
- A general description of control strings
- How to generate remote commands from the host
- A summary of TCS status reports
- A summary of selectable modes
- Detailed descriptions of the TCS Mode commands

Except for the TCS Mode commands, which are described in this section, commands mentioned in this section are described in detail in Sections 4 through 8 of this manual. Each section describes the commands related to a specific task: controlling the Setup Screen and the serial interface (Section 4); displaying characters on the screen (Section 5); programming the touch panel (Section 6); programming the keyboard (Section 7); and requesting status information from the TCS (Section 8).

For quick reference to the detailed description of a particular command, refer to the command lookup tables in Appendix D.

CODING STANDARDS

The TCS conforms to the following standards for representing characters and controls:

- ANSI X3.4-1977 American Code for Information Interchange (ASCII)
- ANSI X3.64-1979 Additional Controls for Use With the American National Standard for Information Interchange

All TCS controls comply with American National Standards Institute (ANSI) Standard X3.64-1979. Some TCS controls are ANSI-specified; others are ANSI-compatible DEC(R)-private* or ANSI-compatible Fluke-private.

The ANSI standard referred to throughout the rest of this manual is Standard X3.64-1979.

CHARACTER CODES

The TCS and the host communicate by sending character codes to each other. A character code is a sequence of 7 or 8 bits that represents a character. The character codes incorporate and extend the ASCII code set.

ASCII established a widely used set of 7-bit codes for representing 128 characters for transmission. The code set includes codes for displayable characters (including letters, numbers, and punctuation) and non-displayable control characters (which perform specific functions, such sounding a beeper or moving a cursor).

To represent the 128 ASCII characters plus an additional 128 characters, the TCS extends the ASCII code set by appending an additional high-order bit, thereby converting the 7-bit ASCII codes to 8-bit codes. The host and the TCS can thus send each other any of 256 possible characters codes (decimal 0 through 255).

COMMUNICATION ENVIRONMENTS

The TCS can communicate with the host using either 7 or 8 data bits to represent each character. The number of data bits is selected by setting the Data Bits parameter in the Setup Screen. (See the Data Bits command in Section 4.)

When the TCS is set for 7-bit communication, the TCS sends and receives 7-bit character codes. Seven-bit communication allows the host and the TCS to send and receive the lower 128 character codes directly. The upper 128 characters are sent and received using 7-bit codes in conjunction with the control characters Shift Out (⟨SO⟩, decimal 14) and character Shift In (⟨SI⟩, decimal 15). This technique is explained in detail Section 5, under the heading, Select Character Set Command.

When the TCS is set for 8-bit communication, the TCS sends and receives 8-bit character codes. Eight-bit communication allows the host and the TCS to send and receive the full set of 256 character codes directly.

CHARACTER SETS

The TCS has a set of displayable characters that correspond to the character codes that can be received from the host. The characters are divided into two sets. The Standard Character Set corresponds to the lower 128 character codes; the Extended Character Set corresponds to the upper 128 character codes. Both character sets are illustrated in Appendix B.

Standard Character Set

The Standard Character Set consists of the ASCII character set. The corresponding character codes (decimal 0 through 127) represent displayable characters and non-displayable control characters.

*DEC is a registered trademark of Digital Equipment Corporation, Inc.

CONTROL CHARACTERS

Columns 0 and 1 of the Standard Character Set correspond to character codes decimal 0 through 31, which are called control characters. Control characters are non-displayed, single-byte codes that perform specific functions in the TCS, such as sounding the beeper or moving the cursor. Control characters do not cause a character to be displayed.

Of the 32 control characters defined by ASCII, the TCS recognizes the 14 listed in Table 3-1. The TCS ignores the remaining 18 control characters.

For reference, columns 0 and 1 of the Standard Character Set show the ASCII mnemonics for the respective control characters; these mnemonics are never displayed. For clarity, the mnemonics are enclosed in angle brackets (e.g., ⟨BEL⟩) in text throughout this manual.

Table 3-1. Control Characters Recognized by the TCS

MNE-MONIC	HEX	NAME	EFFECT
<BEL>	07	Bell	Sounds the beeper.
<BS>	08	Back Space	Moves cursor left one space.
<HT>	09	Horizontal Tab	Moves cursor right to next tab stop.
<LF>	0A	Line Feed	Moves cursor to next line, same column.*
<VT>	0B	Vertical Tab	Same as <LF>.
<FF>	0C	Form Feed	Same as <LF>.
<CR>	0D	Carriage Return	Moves cursor to first column.
<S0>	0E	Shift Out	Selects extended character set.
<S1>	0F	Shift In	Selects standard character set.
<DC1>	11	XON	Enables data stream to host.
<DC3>	13	XOFF	Halts data stream to host.
<CAN>	18	Cancel	If inside a control string, cancels it.
<SUB>	1A	Substitution	If inside a control string, cancels it.
<ESC>	1B	Escape	Introduces a control string.

* <LF>, <VT>, and <FF> move the cursor to column 1 of the next line if New Line Mode [LNM] is set. See new Line Mode Command, Section 5.

DISPLAYABLE CHARACTERS

Columns 2 through 7 of the Standard Character Set correspond to character codes decimal 32 through 127. These codes, when received by the TCS, cause the TCS to display the respective characters at the cursor position. (Character code decimal 127 is ignored; for reference, its place in the Standard Character Set in Appendix B is held by the mnemonic DT corresponding to ASCII mnemonic, "Delete".) For more about displaying characters, see Section 5.

Extended Character Set

The Extended Character Set provides the TCS with international characters, error characters, characters for drawing boxes, and other graphic characters. The Extended Character Set is illustrated in Appendix B.

BOXTYPES

Columns 8 and 9 of the Extended Character Set correspond to character codes decimal 128 through 159. These character codes are ANSI-defined 8-bit control codes which are ignored by the TCS. The corresponding positions in the Extended Character Set contain Boxtype characters, which the TCS uses for drawing borders around defined regions. Boxtype characters can be displayed only by sending the Outline a Region command (described in Section 6).

OTHER EXTENDED CHARACTERS

Columns 10 through 15 of the Extended Character Set correspond to character codes decimal 160 through 255. These codes, when received by the TCS, cause the TCS to display the respective characters at the cursor position. (Character code decimal 255 is ignored; for reference, its place in the Extended Character Set in Appendix B is held by the corresponding hexadecimal value, FF.)

The TCS may also display some of these characters indirectly. For example, the TCS displays the error character PE when the TCS detects a parity error. Likewise, the TCS displays the international characters if the National Replacement Code has been set for a particular nationality and the TCS receives certain character codes corresponding to the Standard Character Set.

For more about displaying characters (including a description of the National Replacement Code), see Section 5.

TOUCH CONTROL SCREEN COMMANDS

Touch Control Screen commands are the actions that the host or user can take to configure the TCS. Commands allow the host to display touchkeys and text, select character attributes, move the cursor, delete text from the display, etc. Commands also allow the user (if he or she has access to the Setup Screen) to change Setup Screen parameters, change the display alignment, run tests, etc.

All Touch Control Screen commands are summarized in Table 3-2. For clarity, most control characters are not repeated in this table.

TYPES OF COMMANDS

Touch Control Screen commands fall into three categories, according to their source:

- Local commands
- Remote commands
- Local/remote commands

The following paragraphs describe each type.

Local Commands

Local commands are actions that the user can take by means of the Setup Screen or by pressing certain keys on the optional keyboard.

For example, the user issues the Baud Rate command by entering the Setup Screen and, using touchkeys or the keys on the optional keyboard, selecting the baud rate. Likewise, the user can send the Short Break command by pressing the Break key.

Table 3-2. Summary of Touch Control Screen Commands

COMMAND	MNEMONIC	SOURCE	HOST USAGE
TCS Mode Commands (Section 3)			
Reset Mode	[RM]	Remote	
For ANSI-specified modes:			<ESC> [<Ps> ; ... ; <Ps> l
For DEC-private modes:			<ESC> [? <Ps> ; ... ; <Ps> l
For Fluke-private modes:			<ESC> [> <Ps> ; ... ; <Ps> l
Set Mode	[SM]	Remote	
For ANSI-specified modes:			<ESC> [<Ps> ; ... ; <Ps> h
For DEC-private modes:			<ESC> [? <Ps> ; ... ; <Ps> h
For Fluke-private modes:			<ESC> [> <Ps> ; ... ; <Ps> h
Setup Screen Commands (Section 4)			
Setup Lockout Mode	{FSULM}	Remote	<ESC> [> 5 l (to reset) <ESC> [> 5 h (to set)
Save Setup	{FSSU}	Local/Remote	<ESC> [1 z
Recall Setup	{FRSU}	Local/Remote	<ESC> [2 z
Reset	[RIS]	Local/Remote	<ESC> <Ps> c
Communication Commands (Section 4)			
Baud Rate		Local	
Data Bits		Local	
Parity Enable		Local	
Parity Sense		Local	
Stop Bits		Local	
Local/Remote Mode		Local	
Reporting Format	{FRF}	Remote	<ESC> [<P1> ; <P2> ; <P3> w
Clear User Inputs	{FCUI}	Remote	<ESC> [7 z
Character Displaying Commands (Section 5)			
Display Normal Characters		Remote	<characters>
Display Double-Width Line	(DECDWL)	Remote	<ESC> # 6
Display Double-Size Line	(DECDHL)	Remote	<ESC> # 3 (top half) <ESC> # 4 (bottom half)
Display Normal Line	(DECSWL)	Remote	<ESC> # 5
Erase Character	[ECH]	Remote	<ESC> [<Pn> X
Erase in Line	[EL]	Remote	<ESC> [<Ps> K
Erase in Display	[ED]	Remote	<ESC> [<Ps> J
Character Interpretation Commands (Section 5)			
Auto Wrap-Around Mode	(DECAWM)	Local/Remote	<ESC> [? 7 l (to reset) <ESC> [? 7 h (to set)
Send-Receive Mode	[SRM]	Local/Remote	<ESC> [1 2 l (to reset) <ESC> [1 2 h (to set)
New Line Mode	[LNM]	Local/Remote	<ESC> [2 0 l (to reset) <ESC> [2 0 h (to set)
Select Character Set	[SCS]	Remote	<SO> (to select extended set) <SI> (to select standard set)
NOCHANGE Attribute Mode	{FNCAM}	Remote	<ESC> [> 3 l (to reset) <ESC> [> 3 h (to set)

Table 3-2. Summary of Touch Control Screen Commands (cont)

COMMAND	MNEMONIC	SOURCE	HOST USAGE
National Replacement Code	{FNRC}	Local/Remote	<ESC> [4 ; <Ps> z
Set Character Attributes	[SGR]	Remote	<ESC> [<Ps> ; ... ; <Ps> m
Scrolling Region	(DECSTBM)	Remote	<ESC> [<Pt> ; <Pb> r
Origin Mode	(DECOM)	Remote	<ESC> [? 6 l (to reset)
			<ESC> [? 6 h (to set)
Cursor Commands (Section 5)			
Move Cursor to Absolute Position	[CUP]	Remote	<ESC> [<Pl> ; <Pc> H
Move Cursor Forward	[CUF]	Remote	<ESC> [<Pn> C
Move Cursor Backward	[CUB]	Remote	<ESC> [<Pn> D
Move Cursor Up	[CUU]	Remote	<ESC> [<Pn> A
Move Cursor Down	[CUD]	Remote	<ESC> [<Pn> B
Next Line	[NEL]	Remote	<ESC> E
Index	[IND]	Remote	<ESC> D
Reverse Index	[RI]	Remote	<ESC> M
Read Cursor Position	[CPR]	Remote	<ESC> [6 n
Read Character Under Cursor	{FRCUC}	Remote	<ESC> [> 3 n
Read Attributes Under Cursor	{FRAUC}	Remote	<ESC> [> 4 n
Cursor Type	{FCT}	Local/Remote	<ESC> [<Ps> ; ... ; <Ps> v
Screen Appearance Commands (Section 5)			
Screen Background Mode	(DECSCNM)	Local/Remote	<ESC> [? 5 l (normal)
			<ESC> [? 5 h (reverse)
Display Activity	{FDA}	Local/Remote	<ESC> [3 ; <Ps> z
Horizontal Alignment	{FHA}	Local/Remote	<ESC> [6 ; <Ps> z
Vertical Alignment	{FVA}	Local/Remote	<ESC> [5 ; <Ps> z
Vertical Refresh Rate		Local	
Region Commands (Section 6)			
Erase a Region	{FER}	Remote	<ESC> [8 ; <Pl> ; <Pc> ; <Pv> t
Outline a Region	{FOR}	Remote	<ESC> [6 ; <Pl> ; <Pc> ; <Pb> t
Modify Character Attributes in a Region	{FMCAIR}	Remote	<ESC> [7 ; <Pl> ; <Pc> ; <Pv> t
Touch Panel Commands (Section 6)			
Polled Touch Mode	{FPTM}	Remote	<ESC> [> 1 l (to reset)
			<ESC> [> 1 h (to set)
Read Touch Cell Status	{FRTS}	Remote	<ESC> [> 2 n
Auto-Repeat Rate	{FARR}	Remote	<ESC> [2 ; <Pn> u
Touch Cell Audible Attribute	{FTAA}	Remote	<ESC> [1 ; <Ps> u
Touch Panel Lockout Mode	{FTPLM}	Remote	<ESC> [> 2 l (to reset)
			<ESC> [> 2 h (to set)
Keyboard Commands (Section 7)			
Keyboard Lockout Mode	[KAM]	Remote	<ESC> [2 l (to reset)
			<ESC> [2 h (to set)
Keypad Mode	(DECKPAM)	Remote	<ESC> = (for Application Mode)
	(DECKPNM)	Remote	<ESC> > (for Numeric Mode)

Table 3-2. Summary of Touch Control Screen Commands (cont)

COMMAND	MNEMONIC	SOURCE	HOST USAGE
Send Long Break		Local	
Send Short Break		Local	
Local/Remote Mode (see Section 4)		Local	
Status Reporting Commands (Section 8)			
Power-Up Interrupt Mode	{FPUIM}	Remote	<ESC> [> 4 l (to reset) <ESC> [> 4 h (to set)
Request Power Status	{FRPS}	Remote	<ESC> [> 0 n
Request TCS Identification	[DA]	Remote	<ESC> [c OR <ESC> [0 c
Request TCS Status	[DSR]	Remote	<ESC> [5 n
Self-Test Commands (Section 8)			
Continuous Integrity Test	{FCIT}	Local/Remote	<ESC> [2 ; 9 ; <Ps> y
Request ROM Test Report	{FRRTR}	Remote	<ESC> [> 6 n
Request Non-Volatile Memory Test Report	{FRETR}	Remote	<ESC> [> 7 n
Request RAM Test Report	{FRRATR}	Remote	<ESC> [> 8 n
Request Touch Panel Test Report	{FRTTR}	Remote	<ESC> [> 9 n

NOTES:

- Mnemonics in square brackets [ ] are ANSI-specified commands.
- Mnemonics in braces { } are ANSI-compatible, Fluke-private commands.
- Mnemonics in parentheses ( ) are ANSI-compatible, DEC®-private commands. (DEC is a registered trademark of Digital Equipment Corporation.)
- Optional parameters are represented in angle brackets (e.g., <Ps>).

In addition to these actions, the user can cause the TCS to transmit characters to the host by pressing touch cells or keyboard keys. However, these actions are not referred to as local commands. Touch cell reporting is described in Section 6; keyboard reporting is described in Section 7.

Remote Commands

Remote commands are characters (or sequences of characters) sent by the host to the TCS over the serial interface.

Remote commands are used to control the interface between the TCS and the user (for example, displaying characters on the screen, defining touchkeys, changing character attributes, barring the user from the Setup Screen, etc.). Remote commands are also used to control the interface between the TCS and the host (for example, selecting a reporting format for TCS status reports).

NOTE

To facilitate software development, remote commands can also be entered from the optional keyboard by setting the Local/Remote Mode to Local. See the heading, Local/Remote Mode Command, in Section 4.

There are three types of remote commands: display characters; control characters; and control strings. Display characters and control characters are described earlier in this section.

A control string is a sequence of multiple characters, beginning with an Escape character (⟨ESC⟩), that causes the TCS to perform a specific function. For example, the host can reverse the TCS display background by sending the following control string:

⟨ESC⟩ ? 5 h

NOTE

For clarity, this manual shows spaces between the characters in each control string. These spaces must be omitted when programming the TCS.

Control strings are described in more detail later in this section.

Local/Remote Commands

Local/remote commands are remote commands that can also be issued as local commands. These commands can be sent remotely by the host and can be issued by the user from the Setup Screen, Test Screen, or Alignment Screen.

An example of a local/remote command is the Cursor Type command, which selects the type of cursor that is displayed. The Cursor Type command can be sent as a control string from the host. For example, the string

⟨ESC⟩ [3 v

selects a reverse-video block cursor. The Cursor Type command can also be issued by the user by entering the Setup Screen and selecting the cursor type using touchkeys or the optional keyboard.

CONTROL STRINGS

A control string is a remote command that consists of a special sequence of two or more characters starting with the Escape character (⟨ESC⟩). Control strings provide the host with a variety of commands that control the TCS.

The Escape character indicates to the TCS that it should interpret the next character(s) as belonging to a command. The command, if in the correct format, causes the TCS to perform a specific function. If the command is not in the correct format, or if it is not recognized, the TCS ignores the command.

All control strings supported by the TCS are summarized in Table 3-2, grouped by function. Some of the control strings include optional numeric and/or selective parameters, which are represented in Table 3-2 in angle brackets (e.g., ⟨Ps⟩). Numeric and selective parameters are discussed more fully late. in this section. The specific parameters for each command are described in the detailed command descriptions later in this manual.

Types of Control Strings

The control strings supported by the TCS can be grouped into two categories, according to their composition:

- Simple Escape sequences
- Control sequences

Simple Escape Sequences

Simple Escape sequences may be sent by the host exactly as shown in Table 3-2, and do not include optional parameters. These control strings begin with the ⟨ESC⟩ character, followed by the character 0, 1, c, D, E, M, =, ⟩, ? or #, possibly followed in turn by other characters. For example, the Index command consists of the control string ⟨ESC⟩ D. All variations of these control strings are listed in Table 3-2 and again in the detailed descriptions of the respective commands.

Control Sequences

The general format for a control sequence is:

⟨ESC⟩ [⟨Pr⟩ ⟨P1⟩ ; ⟨P2⟩ ; ... ; ⟨Pn⟩ F

where:

⟨ESC⟩ [	= Control Sequence Introducer (always ⟨ESC⟩ [ )
⟨Pr⟩	= Optional private command character (? ⟩)
⟨P1⟩	= First optional parameter
⟨P2⟩	= Second optional parameter
⟨Pn⟩	= Last optional parameter
F	= Final character

A control sequence always begins with the Control Sequence Introducer (CSI) and ends with a Final character. The Control Sequence Introducer is always the two characters ⟨ESC⟩ [. The Final character is a single character in the Standard Character Set from @ through ~ (decimal 64 through 126), inclusive. The character used for the Final character varies, depending upon the command.

Between the Control Sequence Introducer and the Final character are an optional private command character and optional parameters.

The private command character identifies the control sequence as a privately interpreted, ANSI-compatible control string. If used, the private command character is either the character ? or ⟩. The character ? identifies the control string as ANSI-compatible, DEC-private. The character ⟩ identifies the control string as ANSI-compatible, Fluke-private.

An optional parameter is either a numeric parameter (which passes a numeric value) or a selective parameter (which selects a particular subfunction from a specified list). Numeric and selective parameters are described more completely under the next heading.

The following are examples of valid control sequences:

⟨ESC⟩ [5 B	Moves the cursor down five lines.
⟨ESC⟩ [1 2 ; 4 0 H	Moves the cursor to line 12, column 40.
⟨ESC⟩ [; ; 1 3 w	Adds a carriage return to all TCS reports.

〈ESC〉[?7h	Turns on Auto Wrap-Around Mode (a DEC-private command).
〈ESC〉[>3n	Reads character under cursor (a Fluke-private command).

Control Sequence Parameters

A control sequence parameter is a string of the characters 0 through 9. The TCS interprets the string of digits as a decimal number. Leading zeros are ignored.

If a control sequence contains more than one parameter, the parameters must be separated by semicolons (;) (decimal 59). A semicolon is not required before the first parameter or after the last parameter.

A control sequence can contain a maximum of 10 parameters. If more than 10 parameters are contained in an otherwise valid control sequence, the right-most additional parameters are ignored.

There are two types of parameters: numeric and selective. Each is described below.

NUMERIC PARAMETERS

A numeric parameter is an optional parameter in a control sequence that passes a numeric value to the TCS. This value controls the scope or range of a command.

If a control sequence uses multiple numeric parameters, the parameters must be separated by semicolons (decimal 59). Any one of the parameters can be omitted from a control sequence, in which case the parameter assumes its default value.

For example, consider the Scrolling Region command. The Scrolling Region command (which is fully documented in Section 5) is a control sequence containing numeric parameters that define the portion of the display which will be designated as the scrolling region. The Scrolling Region command is issued by the host in the following format:

〈ESC〉[〈Pt〉;〈Pb〉r

Notice that the Scrolling Region command uses two numeric parameters. The first numeric parameter, 〈Pt〉, designates the top line of the scrolling region; the second numeric parameter, 〈Pb〉, designates the bottom line of the scrolling region.

The following examples of the Scrolling Region command illustrate how numeric parameters determine the size of the scrolling region:

〈ESC〉[r	Both numeric parameters are omitted. Therefore, 〈Pt〉 defaults to line 1 and 〈Pb〉 defaults to line 24. The entire display, lines 1 through 24, is defined as the scrolling region. Note that r is the Final character for this control sequence.
〈ESC〉[;30r	Same as above; the extra parameter (30) is ignored.
〈ESC〉[;18r	Lines 1 through 18 become the scrolling region.
〈ESC〉[4;r	Lines 4 through 24 become the scrolling region.

⟨ESC⟩ [2 2 ; 4 r	The command is ignored because the parameter designating the bottom line of the scrolling region (4) is less than or equal to the parameter designating the top line (22).

Numeric parameters outside the valid range are ignored or limited within a reasonable range, as specified in the detailed description of each command.

SELECTIVE PARAMETERS

A selective parameter is an optional parameter in a control sequence that selects a particular effect from a list of possible effects.

Each effect is associated with a specific numeric value. When the value is passed to the TCS and the command is executed, the effect specified by that value is produced. The list of selective parameters (together with the numeric parameters) can vary in length from zero to 10 parameters (inclusive).

Some control sequences allow multiple selective parameters to be combined in a single control sequence to select a combination of effects. (When this is possible, it is noted in the detailed command description.) For these commands, the selective parameters may be combined in any order. If the selective parameters within a control sequence conflict with each other, the latest (rightmost) parameter is used. Invalid selective parameters are ignored.

For example, consider the Set Character Attributes command. The Set Character Attributes command (which is fully documented in Section 5) is a control sequence containing selective parameters that select the visual attributes (e.g., highlight, underline, blink, etc.) for displayed characters. The Set Character Attributes command is issued by the host in the following format:

⟨ESC⟩ [⟨Ps⟩ ; ... ; ⟨Ps⟩ m

Each ⟨Ps⟩ represents one of 11 possible selective parameters.

The following examples of the Set Character Attributes command illustrate how selective parameters control the visible attributes of displayed characters:

⟨ESC⟩ [m	All video attributes are turned off. The Final Character is m.
⟨ESC⟩ [4 ; 1 ; 5 m	Selects underline (parameter 4), highlight (parameter 1), and blink (parameter 5) attributes. The Final character is m.
⟨ESC⟩ [1 ; 4 ; 5 m	Same as above. The parameters may appear in any order.
⟨ESC⟩ [1 ; 4 ; 5 ; 2 5 m	Selects highlight (parameter 1) and underline (parameter 4) attributes, and turns blinking off (parameter 25). Parameter 5 (select blinking) is overridden by parameter 25.

How the TCS Interprets Control Sequences

The TCS performs two steps when it interprets a control sequence:

1. Control Sequence Parsing

   During parsing, all characters in the control string are stored for use as a TCS command. If the control sequence is not in a valid format, the TCS ignores the control sequence. If the sequence is properly formatted, the TCS performs step 2.

2. Command Lookup

   The TCS looks up a command using the combination of the control sequence's private command character, the Final character, and possibly the first parameter. The TCS does not have a command for every possible control sequence combination. If the TCS has a corresponding command, the TCS accepts the parameters and performs the command. If the TCS does not have a corresponding command, the TCS ignores the control sequence.

For example, the sequence

⟨ESC⟩ [1 2 ; 5 A

is in the correct format, and can be parsed by the TCS. However, when the corresponding command is looked up, no corresponding command is found. Hence, the sequence is ignored by the TCS.

The parsing step assumes that all parameters are omitted from the command. If a parameter is found, its value is stored with the control sequence. When the command is executed, the list of parameters is provided. If more parameters are specified in the sequence than expected for the command, the TCS ignores the additional parameters. If fewer parameters are specified than expected, the omitted parameters assume default values.

Cancelling Control Strings

A control string can be cancelled before the entire string is sent by sending either a ⟨CAN⟩ or ⟨SUB⟩ character to the TCS. Either character causes the TCS to ignore all previously received characters up to and including the previous ⟨ESC⟩ character.

HOW TO GENERATE REMOTE COMMANDS

How remote commands are sent from the host computer to the TCS depends entirely on the specific host computer and application software. Different computers and application programs may handle RS-232-C I/O (input/output) communication differently.

The following examples of code fragments illustrate how the BASIC and C programming languages might be used to generate a control string. Both examples send the control string

⟨ESC⟩ [2 J

which clears the TCS display.

- Example using BASIC:

```
ES$ = CHR$(27)
...
PRINT #1, ES$;"[2J";
```

- Example using C:

```
printf( "\033[2J" );
```

For specific information about sending data to the TCS, consult the documentation for the host computer or application software in use.

STATUS REPORT SUMMARY

The host can query the TCS for a wide range of status reports. The status reports allow the host to read the contents and attributes of the TCS display, sense touch cell closures, and verify that the TCS is operating properly.

Summary of Status Queries and Responses

The host can query the TCS for the following information:

- The cursor position
- The character under the cursor
- The character attributes under the cursor
- Touch cell closures (when the Polled Touch Mode is set)
- Operational status
- Power-loss history
- Self-test results

Table 3-3 summarizes commands the host can send to query the status of the TCS. Table 3-3 also shows the status reports sent by the TCS in response to the host's queries. For additional information about any of these commands or status reports, refer to the section indicated after each command name.

(Table 3-3 does not include the codes sent to the host when keys on the optional keyboard are pressed or when touch cells are pressed while the Polled Touch Mode is reset. For keyboard codes, see Section 7; for touch cell codes, see Section 6.)

Types of Status Queries and Responses

The commands that query the status of the TCS (and the responses of the TCS) are divided into two types:

- ANSI-specified commands, which have the form:

  ⟨ESC⟩ [... n

- ANSI-compatible, Fluke-private commands, which have the form:

  ⟨ESC⟩ [⟩ ... n

The TCS responses to these commands follow the same format as the respective commands except for the cursor position report, which has a terminator of R instead of n.

The Reporting Format command can be used to cause the TCS to append a common terminating character to all TCS status responses. The Reporting Format command can also be used to specify different introducer characters. (This command is explained in detail in Section 4.)

Table 3-3. Summary of Status Queries and Reports

HOST COMMAND	TCS RESPONSE	MEANING
<ESC> [6 n		**Read Cursor Position command** (Section 5). Requests cursor position.
	<ESC> [<Pl> ; <Pc> R	The cursor is at line <Pl> and column <Pc>.
<ESC> [> 3 n		**Read Character Under Cursor command** (Section 5). Requests character at the current cursor position.
	<ESC> [> 3 ; <Pc> n	The decimal value of the character is <Pc>.
<ESC> [> 4 n		**Read Attributes Under Cursor command** (Section 5). Requests character attributes at current cursor position.
	<ESC> [> 4 ; <Phi> ; <Pul> ; <Pblink> ; <Prv> n	<Phi> = highlight (1 = on, 22 = off) <Pul> = underline (4 = on, 24 = off) <Pblink> = blink (5 = on, 25 = off) <Prv> = reverse video (7 = on, 27 = off)
<ESC> [> 2 n		**Read Touch Cell Status command** (Section 6). Requests last touch cell touched but not yet reported.
	<ESC> [> 2 ; <Pk> n	Last touch cell touched but not yet reported is <Pk>. (If the Polled Touch Mode is reset, this sequence may be generated asynchronously.)
<ESC> [5 n		**Request TCS Status command** (Section 8). Requests operational status of TCS.
	<ESC> [0 n	No malfunction since last power-up or reset.
	<ESC> [3 n	Malfunction since last power-up or reset. (TCS continues to operate.)

Table 3-3. Summary of Status Queries and Reports (cont)

HOST COMMAND	TCS RESPONSE	MEANING
<ESC> [> 0 n		**Request Power Status command** (Section 8). Checks for power loss since last inquiry.
	<ESC> [> 0 n	No power loss has occurred
	<ESC> [> 1 n	Power loss has occurred. (If the Power-Up Interrupt Mode is set, this sequence is sent asynchronously.)
<ESC> [> 6 n		**Request ROM Test Report command** (Section 8). Tests results of ROM checksum tests.
	<ESC> [> 6 ; <Ploops> ; <Pfail> ; <Psum> n	
		Rom tested <Ploops> times and failed <Pfail> times. The most most recent sum in error is <Psum>.
<ESC> [> 7 n		**Request Non-Volatile Memory Test Report command** (Section 8). Requests results of non-volatile memory tests.
	<ESC> [> 7 ; <Ploops> ; <Pfail> ; <Psum> n	
		Non-volatile memory tested <Ploops> times and failed <Pfail> times. The most recent sum in error is <Psum>.
<ESC> [> 8 n		**Request RAM Test Report command** (Section 8). Requests RAM test results.
	<ESC> [> 8 ; <Ploops> ; <Pfail> ; <Paddr> ; <Perror> ; <Phistory> n	
		RAM tested <Ploops> times and failed <Pfail> times. The last failure occurred at address <Paddr> and resulted in data bit errors as shown in <Perror>. The history of all data bit errors is contained in <Phistory>.
<ESC> [> 9 n		**Request Touch Panel Test Report command** (Section 8). Requests touch panel test results.
	<ESC> [> 9 ; <Ploops> ; <Pfail> ; <Perror> n	
		Touch panel tested <Ploops> times and failed <Pfail> times. The most recent error occurred at touch cell <Perror> (if Touch Cell Shorted Test is performed) or with data bit errors as shown in <Perror> (if Touch Cell Loopback Test is performed).

SUMMARY OF SELECTABLE MODES

A TCS mode is a state that can be set or reset by the host or user to control the operation of the TCS. The TCS supports several modes specified by the ANSI standard. In addition, the TCS supports several DEC-private and Fluke-private modes. The complete set of TCS modes is listed in Table 3-4.

NOTE

All TCS modes are fully compatible with the ANSI standard, which provides for the utilization of private modes.

Each mode has two states: set or reset. As Table 3-4 indicates, some modes can be set or reset by the host, some by the user, and some by both the host and the user.

Table 3-4. Summary of Selectable Modes

MODE	MNEMONIC	SOURCE	<Ps>	SECTION
ANSI-Specified Modes (1)				
Keyboard Lockout Mode	KAM	Remote	2	7
Send-Receive Mode	SRM	Local (4)/Remote	12	5
New Line Mode	LNM	Local/Remote	20	5
DEC-Private Modes (2)				
Screen Background Mode	DECSCNM	Local/Remote	5	5
Auto Wrap-Around Mode	DECAWM	Local/Remote	7	5
Origin Mode	DECOM	Remote	6	5
Fluke-Private Modes (3)				
Polled Touch Mode	FPTM	Remote	1	6
Touch Panel Lockout Mode	FTPLM	Remote	2	6
NOCHANGE Attribute Mode	FNCAM	Remote	3	5
Power-Up Interrupt Mode	FPUIM	Remote	4	8
Setup Lockout Mode	FSULM	Remote	5	4

NOTES:

(1) ANSI-specified modes are set and reset by the following commands:

<ESC> [<Ps> ; ... ; <Ps> l (to reset)
<ESC> [<Ps> ; ... ; <Ps> h (to set)

(2) DEC-private modes are set and reset by the following commands:

<ESC> [? <Ps> ; ... ; <Ps> l (to reset)
<ESC> [? <Ps> ; ... ; <Ps> h (to set)

(3) Fluke-private modes are set and reset by the following commands:

<ESC> [> <Ps> ; ... ; <Ps> l (to reset)
<ESC> [> <Ps> ; ... ; <Ps> h (to set)

(4) The Send-Receive Mode is controlled locally by the Local Echo parameter in the Setup Screen.

The host can set or reset TCS modes one at a time (using individual mode commands) or in combination (using the Set Mode command or the Reset Mode command). For example, the Send-Receive Mode and the New Line Mode (both of which are ANSI-specified modes) can be set using two separate commands:

〈ESC〉 [1 2 h (a form of the Send-Receive Mode command)

〈ESC〉 [2 0 h (a form of the New Line Mode command)

Or they can be set with a single command, as follows:

〈ESC〉 [1 2 ; 2 0 h (a form of the Set Mode command)

NOTE

Only modes of the same type can be set or reset within a single control string. For example, the ANSI-specified New Line Mode and the Fluke-private Touch Panel Lockout Mode cannot be set with a single control string.

A detailed description of each TCS mode is provided with the description of the respective mode command, which is located in the section indicated in Table 3-4. The Set Mode and Reset Mode commands are described under the next heading.

TCS MODE COMMANDS

TCS Mode commands set or reset one or more TCS modes. The TCS Mode commands are:

- Reset Mode (Remote)
- Set Mode (Remote)

These commands are described in detail in the following pages. For ease of reference, each command description begins at the top of a new page.

NOTE

Where applicable, command names are followed by the appropriate mnemonic. Mnemonics in square brackets [ ] are ANSI-specified commands. Mnemonics in braces { } are ANSI-compatible, Fluke-private commands. Mnemonics in parentheses ( ) are ANSI-compatible, DEC-private commands.

For clarity, this manual shows spaces between the characters in each control string. These spaces must be omitted when programming the TCS.

Reset Mode Command [RM] (Remote)

The Reset Mode command allows the host to reset one or more TCS modes of the same type (i.e., ANSI-specified, DEC-private or Fluke-private).

A detailed description of each TCS mode is provided with the description of the respective mode command, which is located in the section indicated in Table 3-4.

DEFAULT

Each mode has its own default value. See the description of the respective mode command in the section indicated in Table 3-4.

OPERATOR USAGE

The user can set four modes by changing parameters in the Setup Screen (see Table 3-4).

HOST USAGE

〈ESC〉 [〈Ps〉 ; ... ; 〈Ps〉 l (for ANSI-specified modes)

〈ESC〉 [? 〈Ps〉 ; ... ; 〈Ps〉 l (for DEC-private modes)

〈ESC〉 [> 〈Ps〉 ; ... ; 〈Ps〉 l (for Fluke-private modes)

〈Ps〉 is a selective parameter, which determines which mode or modes are to be reset. Table 3-4 shows the value of this parameter for each mode.

The Final character for this command is a lower case l (for "low").

Notice that the Control Sequence Introducer varies depending on the type of mode(s) to be reset:

For ANSI-specified modes:	〈ESC〉 [
For DEC-private modes:	〈ESC〉 [?
For Fluke-private modes	〈ESC〉 [>

POSSIBLE ERRORS

If 〈Ps〉 is omitted or has the value 0, then that parameter is ignored.

If 〈Ps〉 is not a legal value (for the type of mode defined by the Control Sequence Introducer), that parameter is ignored.

EXAMPLES

〈ESC〉 [2 ; 1 2 l

Resets the ANSI-specified modes, Keyboard Lockout Mode (KAM) and Send-Receive Mode (SRM).

〈ESC〉 [? 5 l

Resets the DEC-private mode, Screen Background Mode (DECSCNM).

〈ESC〉 [> 3 ; 1 l

Resets the Fluke-private modes, NOCHANGE Attribute Mode (FNCAM) and Polled Touch Mode (FPTM).

Set Mode Command [SM] (Remote)

The Set Mode command allows the host to set one or more TCS modes of the same type (i.e., ANSI-specified, DEC-private or Fluke-private).

A detailed description of each TCS mode is provided with the description of the respective mode command, which is located in the section indicated in Table 3-4.

DEFAULT

Each mode has its own default value. See the description of the respective mode command in the section indicated in Table 3-4.

OPERATOR USAGE

The user can set four modes by changing parameters in the Setup Screen (see Table 3-4).

HOST USAGE

〈ESC〉 [〈Ps〉 ; ... ; 〈Ps〉 h (for ANSI-specified modes)

〈ESC〉 [? 〈Ps〉 ; ... ; 〈Ps〉 h (for DEC-private modes)

〈ESC〉 [> 〈Ps〉 ; ... ; 〈Ps〉 h (for Fluke-private modes)

〈Ps〉 is a selective parameter, which determines which mode or modes are to be set. Table 3-4 shows the value of this parameter for each mode.

The Final character for this command is a lower case h (for "high").

Notice that the Control Sequence Introducer varies depending on the type of mode(s) to be set:

For ANSI-specified modes:	〈ESC〉 [
For DEC-private modes:	〈ESC〉 [?
For Fluke-private modes	〈ESC〉 [>

POSSIBLE ERRORS

If 〈Ps〉 is omitted or has the value 0, then that parameter is ignored.

If 〈Ps〉 is not a legal value (for the type of mode defined by the Control Sequence Introducer), that parameter is ignored.

EXAMPLES

〈ESC〉 [2 0 h

Sets the ANSI-specified mode, New Line Mode (LNM).

〈ESC〉 [? 7 h

Sets the DEC-private mode, Auto Wrap-Around Mode (DECAWM).

〈ESC〉 [> 4 ; 5 h

Sets the Fluke-private modes, Power-Up Interrupt Mode (FPUIM) and Setup Lockout Mode (FSULM).

Section 4
Controlling the Setup Screen and the Serial Interface

INTRODUCTION

This section describes the commands that control the Setup Screen and the serial interface in the Touch Control Screen (TCS).

Topics include:

- An overview of the volatility of TCS functions
- Setup Screen programming considerations
- Setup Screen commands
- Communication commands

The Setup Screen commands control the user's access to the Setup Screen. They can also be used to save, recall, or reset Setup Screen parameters remotely.

The Communication commands have three functions: configuring the serial interface to meet the communication requirements of the host; selecting whether the TCS accepts remote commands from the host computer or from the keyboard; and clearing user inputs.

OVERVIEW OF FUNCTIONAL VOLATILITY

Table 4-1 provides an overview of the volatility of TCS functions. This table shows the state of the TCS immediately after the following events:

- First power-up or hard reset
- Subsequent power-ups or soft reset
- Execution of the Recall Setup command

A soft reset is executed on remote command from the host or when the user touches RESET or types Shift/Setup on the optional keyboard from within the Setup Screen . A hard reset is executed only on remote command from the host. Soft and hard resets are described in more detail later in this section, under the heading, Reset Command.

The Recall Setup command is described later under its own heading.

Table 4-1. Overview of Functional Volatility

FUNCTION	FIRST POWER-UP OR HARD RESET (1)	LATER POWER-UP OR SOFT RESET (2)	RECALL SETUP
SETUP PARAMETERS			
Background	Normal	Last saved	Last saved
Display Activity	On	Last saved	Last saved
Cursor Type	Slow-blinking block	Last saved	Last saved
NRC	Off	Last saved	Last saved
Baud Rate	4800 (3)	Last saved	Last saved
Data Bits	7 (3)	Last saved	Last saved
Parity Enable	Off (3)	Last saved	Last saved
Parity Sense	Odd (3)	Last saved	Last saved
Stop Bits	1 (3)	Last saved	Last saved
Local Echo	Off	Last saved	Last saved
Local/Remote	Remote	Remote	Remote
New Line	Off	Last saved	Last saved
Auto-Wrap	Off	Last saved	Last saved
Refresh Rate	60 Hz	Last saved	Last saved
(1) These also apply to the state of the TCS after a later power-up or reset with non-volatile memory error. (2) Without non-volatile memory error. (3) These parameters are not changed by a hard reset.			
MISCELLANEOUS CONTROLS			
Send-Receive Mode (4)	Set	Last saved	Last saved
Character Set Selected	Standard	Standard	Unchanged
Power-Up Interrupt	Off	Unchanged	Unchanged
Reporting Format	Default	Unchanged	Unchanged
Setup Lockout Mode	Unlocked	Unlocked	Unchanged
(4) The Send-Receive Mode and Local Echo parameter both control the Local Echo feature, but in opposite senses.			

Table 4-1. Overview of Functional Volatility (cont)

FUNCTION	FIRST POWER-UP OR HARD RESET (1)	LATER POWER-UP OR SOFT RESET (2)	RECALL SETUP
DISPLAY			
Contents	Cleared	Cleared	Unchanged
Cursor Position	Home	Home	Unchanged
Character Attribute Select	Normal	Normal	Unchanged
NOCHANGE Attribute Mode	Off	Off	Unchanged
Horizontal Alignment	Default	Last saved	Last saved
Vertical Alignment	Default	Last saved	Last saved
TOUCH PANEL			
Touch Panel Lockout Mode	Unlocked	Unlocked	Unchanged
Polled Touch Mode	Off	Off	Unchanged
Auto-Repeat Rate	Off	Off	Unchanged
Touch Cell Audible Attribute Mode	Beep	Beep	Unchanged
KEYBOARD			
Keyboard Lockout Mode	Unlocked	Unlocked	Unchanged
Caps Lock	Unlocked	Unlocked	Unchanged
Scroll Lock	Unlocked	Unlocked	Unchanged
Keypad Mode	Numeric	Numeric	Unchanged
HARDWARE			
Self-Tests	Performed	Performed	None
Beeper	Sounded	Sounded	Silent
Input Buffer	Cleared	Cleared	Unchanged
Output Buffer	Cleared	Cleared	Unchanged
RTS	Off → On	On → Off → On	Unchanged
DTR	Off → On	On → Off → On	Unchanged
SRTS	Off → On	On → Off → On	Unchanged
RS-232-C Communications (XON/XOFF control)	Unstalled	Unstalled	Unchanged

SETUP SCREEN PROGRAMMING CONSIDERATIONS

The following paragraphs explain how the host can interact with the Setup Screen. For Setup Screen operating instructions, refer to the User's Guide. For additional information about particular modes, see the sections identified in Table 3-4, in Section 3 of the Programmer's Guide.

Keyboard Lockout

If the keyboard is locked out (i.e., if the Keyboard Lockout Mode is set), the Setup Screen can be accessed only by pressing the rear panel SET UP switch. In some installations, the rear panel SET UP switch may also be inaccessible to the user.

The optional keyboard is never locked out while the Setup Screen is displayed, even if the Keyboard Lockout Mode is set. The Keyboard Lockout Mode setting takes affect again as soon as the Setup Screen is exited.

Touch Panel Lockout

Touch panel input is never locked out while the Setup Screen is displayed, even if the Touch Panel Lockout Mode is set. The Touch Panel Lockout Mode setting takes effect again as soon as the Setup Screen is exited.

Display Activity

Entering the Setup Screen is the only operation that temporarily overrides a Display Activity parameter setting of "off". (The Display Activity parameter controls whether the screen is light or dark.)

If the display is dark because the Display Activity parameter is set to "off" (or because the display has timed out), the display relights when the Setup Screen is called up.

If the Display Activity parameter is set to "off" while the Setup Screen is displayed, the display remains lit until the Setup Screen is exited and then the display darkens.

Display Contents

When the Setup Screen is entered, the characters previously shown on the display are saved in memory, together with their attributes. When the Setup Screen is exited, the previous screen is restored.

Changes to the Setup parameters can be initiated by the user or the host, while the Setup Screen is displayed or when it is not. While the Setup Screen is displayed, changes to the Setup parameters take effect immediately if they are initiated by the user. The changes can be viewed on the display as they are made, with the exception of changes to the Display Activity parameter, which take effect only after the Setup Screen has been exited. Changes to the Setup parameters initiated by the host while the Setup Screen is being displayed are buffered and have no effect until the Setup Screen is exited. If the Setup Screen is not displayed, changes to the Setup parameters initiated by the host take effect immediately.

NOTE

A change to the NRC only affects the characters received after the NRC has been changed.

Host Communication During Setup Session

While the Setup Screen is displayed, the TCS continues to receive characters from the host but does not display or otherwise act on the characters. The TCS stores the characters until its input buffer is nearly full, at which time the TCS transmits an XOFF to the host, instructing the host to halt transmission.

When the Setup Screen is exited, the TCS interprets the characters received from the host during the Setup session and transmits an XON to the host.

Methods of Changing Setup Parameters

On power-up, the TCS checks the non-volatile memory for valid Setup parameter initialization data. If the data in the non-volatile memory are valid, these data are used. If the data in non-volatile memory are invalid, then the default values contained in factory-programmed ROM are used as the initial values for the parameters.

After the parameter values have been initialized by turning on the TCS, the values may be changed by any of three methods:

1. Changing individual parameters using local commands or (where allowed) remote commands.

   The user can change any Setup parameter by using local commands (i.e., using the Setup Screen). The host can change only certain Setup parameters by sending remote commands. The source of control over individual Setup parameters is summarized in Table 4-2.

2. Recalling all parameter values using the Recall Setup command.

   The Recall Setup command replaces all the Setup parameters with the values stored by the last Save Setup command, with the exception of Local/Remote mode. Recall Setup is executed when the user presses RECALL on the Setup Screen (or types Shift/R on the keyboard), or when the host sends the remote command Recall Setup. (See the heading, Recall Setup Command, later in this section.)

Table 4-2. Control Over Individual Setup Parameters

SETUP PARAMETERS	SOURCE OF CONTROL
Background	Local/Remote
Display Activity	Local/Remote
Cursor Type	Local/Remote
NRC	Local/Remote
Baud Rate	Local
Data Bits	Local
Parity Enable	Local
Parity Sense	Local
Stop Bits	Local
Local Echo	Local/Remote (1)
Local/Remote	Local
New Line	Local/Remote
Auto-Wrap	Local/Remote
Refresh Rate	Local

(1) The Local Echo feature is controlled remotely by the Send Receive Mode command.

3. Resetting or recalling parameters by causing either a hard or soft reset using the Reset command.

   The host can perform either a hard reset or a soft reset. The user can perform only a soft reset (by pressing RESET on the Setup Screen or by typing Shift/Setup on the keyboard). For more information on hard and soft resets, see the heading, Reset Command, later in this section.

User/Host Conflict Resolution

Several of the Setup parameters that can be controlled locally by the user from within the Setup Screen can also be programmed by the host with remote commands. (See Table 4-2.) This means that conflict between the actions of the user and the host could occur.

Conflict between the user and the host is resolved as follows:

1. Both the user and the host have can change local/remote Setup parameters with equal priority. A Setup parameter's value remains unchanged until the value is changed by either the user or the host. (A parameter's value will also change if the TCS is turned off before a previous change is saved.)

2. In situations where the host must have absolute control over the configuration of the TCS, the Setup Lockout Mode should be set. This completely bars the user from entering the Setup Screen and changing the configuration of the TCS in any way, yet still allows the user to enter information through the touch panel and optional keyboard. (To set the Setup Lockout Mode, see the heading, Setup Lockout Mode Command, later in this section.)

Permanence of Changes to Setup Parameters

In order to ensure that the Setup parameter values currently in use are saved while the TCS is turned off, a Save Setup command must be be executed. The Save Setup command causes the TCS to store the Setup parameters in non-volatile memory for automatic recall at next power-up. (The Save Setup command is described in detail later in this section.)

The programmer should be aware of three special cases regarding the permanence of changes to operating parameters:

1. The setting of the Local/Remote Mode is never saved and is always restored as "remote".

   This is a safety device that ensures the TCS never powers up or resets into the Local Mode, which could confuse the user or, in installations where the user is barred from the Setup Screen, trap the TCS in the Local Mode.

2. The reporting format is preserved during power losses.

   This ensures that the TCS uses the correct reporting format when it sends a power-up interrupt to the host. (The TCS sends a power-up interrupt only if the Power-Up Interrupt Mode is set.)

3. A hard reset, which is available only to the host, does not affect the communication-related parameters (Baud Rate, Data Bits Parity Enable, Parity Sense, and Stop Bits).

   The host cannot, therefore, inadvertently disrupt communication.

NOTE

In general, a remote soft reset is not recommended. However, if the host is to perform a soft reset, the soft reset should be preceded by a Save Setup command to ensure that communication parameters currently in use are not changed.

SETUP SCREEN COMMANDS

The Setup Screen commands are used to: control the user's access to the Setup Screen, and to save, recall, or reset Setup parameters remotely.

The Setup Screen commands are:

- Setup Lockout Mode command (Remote)
- Save Setup command (Local/Remote)
- Recall Setup command (Local/Remote)
- Reset command (Local/Remote)

Setup Screen commands cannot be used to set Setup Screen parameters individually. The command to set an individual parameter is grouped with commands functionally related to that parameter. For example, to set the Baud Rate parameter, see the heading, Communication commands, later in this section.

The Setup Screen commands are described in detail in the following pages. For ease of reference, each command description begins at the top of a new page.

NOTE

Where applicable, command names are followed by the appropriate mnemonic. Mnemonics in square brackets [ ] are ANSI-specified commands. Mnemonics in braces { } are ANSI-compatible, Fluke-private commands. Mnemonics in parentheses ( ) are ANSI-compatible, DEC-private commands.

For clarity, this manual shows spaces between the characters in each control string. These spaces must be omitted when programming the TCS.

Setup Lockout Mode Command {FSULM} (Remote)

The Setup Lockout Mode command allows the host to lock the user out of the Setup Screen.

This command is useful when the other methods of preventing the user from changing Setup Screen parameters (locking the entire keyboard or making the rear panel SET UP switch inaccessible) are inappropriate. This feature gives the host complete control of the TCS.

The host controls the Setup Lockout Mode using the Set Mode and Reset Mode commands. When the Setup Lockout Mode is reset (the default), the user can enter the Setup Screen by pressing the rear-panel SET UP switch or the Set Up key on the optional keyboard, allowing the user to change the Setup Screen parameters. When the Setup Lockout Mode is set, the rear panel SET UP switch and the Set Up key on the keyboard have no effect on TCS operation.

The state of the Setup Lockout Mode is not preserved during loss of power. If a secure system is required, the host must immediately set the Setup Lockout Mode on reapplication of power. This can be accomplished by programming the host to respond to a power-up interrupt from the TCS. (For more information about power-up interrupts, see the heading, Power-Up Interrupt Command, in this section.)

DEFAULT

Reset. (This setting allows user access to the Setup Screen.)

OPERATOR USAGE

None. (This is a remote command only.)

HOST USAGE

〈ESC〉[〉5 h

Sets the Setup Lockout Mode.

〈ESC〉[〉5 l

Resets the Setup Lockout Mode.

Save Setup Command {FSSU} (Local/Remote)

The Save Setup command saves the current values of the Setup parameters in non-volatile memory.

The saved Setup parameter values are automatically recalled when the TCS is turned on or when a Recall Setup command or Soft Reset command is issued by the user or host.

CAUTION

Non-volatile information is stored in an electrically-erasable programmable read-only memory (EEPROM). The EEPROM is rated for 10,000 write operations. If this number of operations is exceeded, unreliable operation may result.

DEFAULT

Not applicable.

OPERATOR USAGE

The user issues the Save Setup command by entering the Setup Screen and pressing the SAVE touchkey or typing Shift/S on the optional keyboard.

HOST USAGE

⟨ESC⟩ [1 z

POSSIBLE ERRORS

When this command is given, the TCS always attempts to save the Setup parameters, even if the non-volatile memory is malfunctioning. A checksum is calculated and stored with the Setup parameters in non-volatile memory. During power-up or execution of a Recall Setup command, the TCS reads back the parameter data and verifies its integrity with the checksum. If the checksum is in error, the parameter values are not changed and an error is reported in the Operational Status Window of the Setup Screen.

Recall Setup Command {FRSU} (Local/Remote)

The Recall Setup command allows the user or host to recall the Setup parameters that were in effect when the Save Setup command was last executed.

When the Recall Setup command is issued, the Setup parameters in effect at the time are overwritten by the most recently saved Setup parameters. This allows a program to temporarily modify the TCS Setup parameters, then restore the Setup parameters to their original values.

The effects of the Recall Setup command are summarized in Table 4-1, earlier in this section.

DEFAULT

Not applicable.

OPERATOR USAGE

The user issues the Recall Setup command by entering the Setup Screen and pressing the RECALL touchkey or typing Shift/R on the optional keyboard.

HOST USAGE

⟨ESC⟩ [2 z

POSSIBLE ERRORS

When previously saved Setup parameter values are recalled from non-volatile memory by the Recall Setup command, the TCS verifies the checksum of the parameter data. If the checksum is in error, the non-volatile memory has malfunctioned. The Setup parameter values are not changed and an error is reported in the Operational Status Window of the Setup Screen.

Reset Command [RIS] (Local/Remote)

The Reset command allows the user or host to reset the TCS.

The host can perform two types of resets:

- soft reset
- hard reset

The user can only perform the soft reset. The effects of the soft and hard reset are summarized in Table 4-1, earlier in this section.

The soft reset is the type of reset most frequently used. It is, in effect, the equivalent of turning the power off and then on again. The soft reset returns the TCS to the operational state it had immediately following the last power-up, unless new Setup parameters have been saved since the last power-up. (The soft reset recalls the Setup parameters most recently saved in non-volatile memory.)

The hard reset returns the TCS to its factory-programmed default setup state (except for communications parameters, which are not changed). This is useful when the host must guarantee that all parameters are in a known state without having to account for parameter values that may have been saved in non-volatile memory by a Save Setup command. Parameters not effected by a hard reset are: baud rate, data bits, parity enable, parity sense, and stop bits.

While the TCS executes a soft or hard reset, the host serial interface is temporarily disabled. On completion of the reset, the TCS sends an XON to the host. The host can use the XON as notice to resume transmission to the TCS. Alternatively, the host can wait 5 seconds after issuing a Reset command in order to guarantee that the reset has been completed. Any characters sent to the TCS between the reset and the reception of the XON (or before the 5-second delay) may be lost.

DEFAULT

Not applicable.

OPERATOR USAGE

The user can perform a soft reset by touching RESET on the Setup Screen or by typing Shift/Setup on the optional keyboard. The user cannot perform a hard reset.

HOST USAGE

〈ESC〉 〈Ps〉 c

〈Ps〉 is a selective parameter.

If 〈Ps〉 is omitted or 0, a soft reset is performed.

If 〈Ps〉 is 1, a hard reset is performed.

POSSIBLE ERRORS

When performing a soft reset remotely, use caution to avoid accidentally disrupting the communication between the TCS and the host. A soft reset reinitializes the host interface communication parameters (Baud Rate, Data Bits, Parity Sense, etc.) using the values saved by the most recent Save Setup command.

NOTE

In general, a remote soft reset is not recommended. However, if the host is to perform a soft reset, the soft reset should be preceded by a Save Setup command to ensure that communication parameters currently in use are not changed.

COMMUNICATION COMMANDS

The Communication commands have three functions: configuring the serial interface to meet the communication requirements of the host; selecting whether the TCS accepts remote commands from the host computer or from the keyboard; and clearing user inputs. (For a description of the serial interface, see Section 2, Interfacing with the Host Computer.)

The Communication commands are:

- Baud Rate command (Local)
- Data Bits command (Local)
- Parity Enable command (Local)
- Parity Sense command (Local)
- Stop Bits command (Local)
- Local/Remote Mode command (Local)
- Reporting Format command (Remote)
- Clear User Inputs command (Remote)

Many of the communication commands are local (i.e., accessible only through the Setup Screen). This prevents the host from accidentally disrupting communication by setting a parameter incorrectly.

The Communication commands are described in detail in the following pages. For ease of reference, each command description begins at the top of a new page.

NOTE

Where applicable, command names are followed by the appropriate mnemonic. Mnemonics in square brackets [ ] are ANSI-specified commands. Mnemonics in braces { } are ANSI-compatible, Fluke-private commands. Mnemonics in parentheses ( ) are ANSI-compatible, DEC-private commands.

For clarity, this manual shows spaces between the characters in each control string. These spaces must be omitted when programming the TCS.

Baud Rate Command (Local)

The Baud Rate command sets the data transmission and reception speed to one of eight baud rates.

The Baud rate is selected by setting the Baud Rate parameter on the Setup Screen to one of the following values:

- 110
- 300
- 600
- 1200
- 2400
- 4800
- 9600
- 19200

The baud rate setting selects both transmit and receive rates. It is not possible for the TCS to transmit at one rate and receive at another.

DEFAULT

4800 baud.

OPERATOR USAGE

The user selects the baud rate by entering the Setup Screen and setting the Baud Rate parameter to the desired value using touchkeys or the optional keyboard.

HOST USAGE

None. (This is a local command only.)

Data Bits Command (Local)

The Data Bits command selects either seven or eight data bits per ASCII character.

The number of data bits is selected by the user, who sets the Data Bits parameter on the Setup Screen to one of the following values:

- 7
- 8

If the Data Bits parameter is set to 7, the next seven bits (following the start bit) received over the host serial interface are interpreted as data. All characters sent from the TCS to the host when Data Bits is set to 7 use only seven data bits. Start, Stop and Parity bits frame the Data bits and ensure that the data is received by the host. (See Section 2 for more information about data formats.)

Operation with seven data bits allows the direct addressing of the lower 128 characters (the Standard Character Set). This precludes direct addressing of the upper 128 characters (the Extended Character Set) by the host and requires the use of the Select Character Set command to display Extended Characters. (See Section 5 for complete documentation of the Select Character Set command.)

If the Data Bits parameter is set to 8, the next eight bits following the start bit are interpreted as data. This allows the host direct access to the entire character set (128 ASCII characters and 128 Extended Characters), except for the characters shown in Appendix B, which can only be accessed indirectly by way of other commands.

NOTE

Boxtypes, which are in the Extended Character Set, are indirectly addressable even when Data Bits is set to 8. They can only be accessed through the Outline a Region command. For more information, see the Outline a Region command in Section 6.

DEFAULT

Seven (7) data bits.

OPERATOR USAGE

The user selects the number of data bits by entering the Setup Screen and then setting the Data Bits parameter to the desired value using touchkeys or the optional keyboard.

HOST USAGE

None. (This is a local command only.)

Parity Enable Command (Local)

The Parity Enable command enables or disables parity checking and generation. (For an explanation of parity checking, see the heading, Parity Bit, in Section 2.)

Parity checking and generation are enabled or disabled by setting the Parity Enable parameter on the Setup Screen to one of the following values:

- on
- ignore
- off

When Parity Enable is set to "on", parity checking and generation are enabled. If the Parity Sense setting is "even", the TCS transmits even-parity data by appending a parity bit and expects received data to have even parity. If the TCS receives data that has odd parity, the data is displayed as a parity error (P_E). If the Parity Sense setting is "odd", the TCS transmits odd-parity data by appending a parity bit and expects received data to have odd parity. If the TCS receives data that has even parity, the data is displayed as a parity error (P_E).

When Parity Enable is set to "ignore", parity checking is disabled, but even or odd parity generation is enabled. If the Parity Sense setting is "even", the TCS transmits even-parity data by appending a parity bit and expects received data to have a parity bit. However, the TCS does not check the parity of the received data. If the Parity Sense setting is "odd", the TCS transmits odd-parity data by appending a parity bit and expects received data to have a parity bit. However, the TCS does not check the parity of the received data.

When Parity Enable is set to "off", parity checking and generation are disabled. The TCS does not transmit a parity bit and does not expect parity bits in the data it receives. A received character containing a parity bit is displayed as a framing error (F_E).

DEFAULT

Off. (Parity checking and generation are disabled.)

OPERATOR USAGE

The user issues the Parity Enable command by entering the Setup Screen and setting the Parity Enable parameter to the desired value using touchkeys or the optional keyboard.

HOST USAGE

None. (This is a local command only.)

Parity Sense Command (Local)

The Parity Sense command determines whether the TCS uses odd or even parity checking and generation for communication with the host. (For an explanation of parity checking, see the heading, Parity Bit, in Section 2.)

Parity checking is only active when Parity Enable is set to "on". Parity generation is only active when Parity Enable is set to "on" or "ignore". (See the Parity Enable command in this section.)

Odd or even parity is selected by setting the Parity Sense parameter on the Setup Screen to one of the following values:

- odd
- even

If the parity of the received data does not match that specified by the Parity Sense parameter (and Parity Enable is set to "on"), the received data is assumed to be in error.

Whenever a parity error is detected (even within a control sequence) the special character P_E is displayed at the cursor position and the cursor is advanced. In addition, the error message, "Communication parity error", is placed in the Operational Status Window of the Setup Screen. If the error occurs within a control sequence, the control sequence is ignored. The remainder of the control sequence (beyond the error) is interpreted as a string of displayable characters and is, therefore, displayed.

DEFAULT

Odd parity.

OPERATOR USAGE

The user selects the parity sense by entering the Setup Screen and setting the Parity Sense parameter to the desired value using touchkeys or the optional keyboard.

HOST USAGE

None. (This is a local command only.)

Stop Bits Command (Local)

The Stop Bits command sets the TCS to send and receive characters with either one or two stop bits.

The number of stop bits is selected by setting the Stop Bits parameter on the Setup Screen to one of the following values:

- 1
- 2

If the Stop Bits parameter is set to 1, then only one stop bit per character is used for both transmitting and receiving over the host serial interface. If the Stop Bits parameter is set to 2, then two stop bits are used for transmitting and only one stop bit is used for receiving.

DEFAULT

One (1) Stop Bit.

OPERATOR USAGE

The user selects the number of stop bits by entering the Setup Screen and setting the Stop Bits parameter to the desired value using touchkeys or the optional keyboard.

HOST USAGE

None. (This is a local command only.)

Local/Remote Mode Command (Local)

The Local/Remote Mode command controls whether the TCS accepts remote commands from the host computer or from the optional keyboard.

The Local/Remote command sets the TCS either to the Remote Mode (in which the TCS accepts remote commands from the host) or to the Local Mode (in which the TCS accepts remote commands from the keyboard).

The TCS is in the Remote Mode for normal operation. In the Remote Mode, the TCS interprets commands received from the host over the serial interface as remote commands. Inputs received from the keyboard are passed on to the host.

When the TCS is in the Local Mode, the TCS temporarily ignores commands received from the host. Instead, it interprets input received from the keyboard as if the input had come from the host, with the following exceptions:

- The Setup key, which still calls up the Setup Screen
- User input within the Setup, Test, and Alignment Screens

While the TCS is in the Local Mode, the user can generate remote commands locally from the keyboard. It is as if the keyboard were connected in place of the host. Any invalid remote commands that are entered through the keyboard are ignored (just as if the commands had come from the host). Input that arrives from the host is queued up in the input buffer and is not interpreted until the TCS is returned to the Remote Mode.

DEFAULT

Remote Mode. (This is the setting when the TCS is in normal use.)

OPERATOR USAGE

The user selects the Local or Remote Mode by entering the Setup Screen and, using touchkeys or the optional keyboard, setting the Local/Remote parameter to one of the following values:

- remote
- local

HOST USAGE

None. (This is a local command only.)

NOTE

The value of the Local/Remote parameter is not stored and recalled by the Save Setup and Recall Setup commands.

Reporting Format Command {FRF} (Remote)

The Reporting Format command allows the host to specify non-standard introducing characters and a terminating character for all report sequences generated by the TCS.

This command allows the programmer to tailor TCS reports to match the format required by a particular host computer. The Reporting Format command has no effect on the characters generated by pressing keys on the optional keyboard (including multi-character sequences, such as those generated by pressing the function keys).

The default format of a report from the TCS to the host is:

〈ESC〉 [... F

The default introducer characters are 〈ESC〉 and [. The default final character, F, is a single ASCII character that varies with the type of report. (TCS report sequences are summarized in Section 3.)

The Reporting Format command allows the host to reassign the two introducer characters to be any two characters (including control characters). In addition, the Reporting Format command allows the host to specify an additional terminating character (such as 〈CR〉) to be appended to the normal report sequence. Once specified, the reporting format is the same for all TCS-to-host reports.

The reporting format is stored in non-volatile memory. This allows the TCS to send a power-up interrupt to the host using the reporting format programmed before the power was turned off. (The TCS sends a power-up interrupt only if the Power-Up Interrupt Mode is set.)

CAUTION

Non-volatile information is stored in an electrically-erasable programmable read-only memory (EEPROM). The EEPROM is rated for 10,000 write operations. If this number of operations is exceeded, unreliable operation may result.

DEFAULT

The default reporting format for TCS reports is:

〈ESC〉 [... F

OPERATOR USAGE

None. (This is a remote command only.)

HOST USAGE

〈ESC〉 [〈P1〉 ; 〈P2〉 ; 〈P3〉 w

〈P1〉 is the decimal value of the ASCII character that is to be used as the first introducer character. If 〈P1〉 is omitted, the TCS assigns the default decimal value 27 (the 〈ESC〉 character) to the first introducer character.

NOTE

If ⟨P1⟩ or ⟨P2⟩ are omitted, their places must be held by semicolons. For example, to select the default value for ⟨P2⟩, use the command ⟨ESC⟩ [⟨P1⟩ ; ; ⟨P3⟩ w.

⟨P1⟩ and ⟨P2⟩ substitute for previous introducer characters; ⟨P3⟩ does not. ⟨P3⟩ is appended after the existing final character.

POSSIBLE ERRORS

When the Data Bits parameter is set to 7, parameters larger than 127 (decimal) select the ⟨DEL⟩ control character (127 decimal, 7F hex). When the Data Bits parameter is set to 8, parameters larger than 255 select the character 255 decimal (FF hex).

If the reporting format is set when using 8 data bits and the number of data bits is later changed to 7, when sent to the host, any characters in the reporting format above decimal 127 will appear with values 128 lower (i.e., the most significant bit will be dropped).

EXAMPLES

⟨ESC⟩ [0 3 2 ; 4 0 ; 1 3 w

Sets the introducer characters to ⟨SP⟩ (and sets the appended terminator to ⟨CR⟩.

⟨ESC⟩ [w

Resets the introducer characters to their default values (⟨ESC⟩ [) and specifies that no terminator be appended to the final character in the report sequence.

⟨ESC⟩ [; ; 4 3 w

Resets the introducer characters to their default values (⟨ESC⟩ [) and sets the appended terminator to +.

Clear User Inputs Command {FCUI} (Remote)

The Clear User Inputs command allows the host to clear the output buffer of the TCS.

The output buffer contains user input not yet transmitted to the host. and any untransmitted responses to the host's queries for status information. This command is useful when the host wants to ensure that the user's input stays in step with data the host is displaying, even if the host becomes busy for a moment and lags in reading input from the user.

If the user is pressing a touchkey when the Clear User Inputs command is received and the touchkey is auto-repeating, auto-repeating will stop. (For more information on auto-repeating, see the description of the Auto-Repeat Rate command and Polled Touch Mode command in Section 6.)

If the user continues to hold a touchkey after the Clear User Inputs command, then a touch report will be generated for the touchkey as if it had just been pressed for the first time.

DEFAULT

Not applicable.

OPERATOR USAGE

None. (This is a remote command only.)

HOST USAGE

⟨ESC⟩ [7 z

Section 5
Displaying Characters

INTRODUCTION

This section explains how to display characters on the Touch Control Screen (TCS) and how to alter the appearance of the screen. Topics include a description of the available character sets and related commands.

For clarity of organization and ease of reference, the command descriptions are organized into four functional groups:

- Character Displaying Commands
- Character Interpretation Commands
- Cursor Commands
- Screen Appearance Commands

NOTE

In addition to these commands, Region commands can be used to outline and erase rectangular areas of the screen and modify the character attributes within rectangular areas. Region commands are fully documented in Section 6.

TOUCH CONTROL SCREEN CHARACTER SETS

The TCS features a Standard Character Set of 128 characters and an Extended Character Set with an additional 128 characters. Both character sets are illustrated in Appendix B.

The host can address these characters using seven or eight data bits. When eight data bits are used, the Standard Characters are addressed by the codes 00000000 through 01111111, binary (0 through 127, decimal; 0 through 7F, hex), and the Extended Characters are addressed by the codes 10000000 through 11111111, binary (128 through 255, decimal; 80 through FF, hex).

When seven data bits are used, both character sets are addressed by the codes 0000000 through 1111111, binary (0 through 127, decimal; 0 through 7F, hex); the host shifts between the two character sets by sending the Select Character Set command. (The Select Character Set command is described later in this section.)

Standard Character Set

The Standard Character Set consists of the 128-character set defined by the American Standard Code for Information Interchange (ASCII). ASCII is a widely-accepted code set for representing characters in digital form. The ASCII code is used to represent printable characters (including upper and lowercase letters, numbers, and common symbols) and non-printable control characters.

The lower 32 characters are ASCII control characters. Of these, the TCS recognizes the 14 characters listed in Table 3-2 (see Section 3). The other 16 ASCII control characters are ignored.

Extended Character Set

The Extended Character Set includes international characters, boxtype characters, error characters, and miscellaneous graphics characters. The following paragraphs describe some of the types of characters in the Extended Character Set.

INTERNATIONAL CHARACTERS

The International Characters provide characters unique to 11 languages. These characters are used to support National Replacement Codes (NRC). For more information, see the heading, National Replacement Code Command, later in this section.

BOXTYPES

Boxtypes are special characters used in displaying touch targets and borders. Boxtypes are the lower 32 characters in the Extended Character Set (128 through 159, decimal).

The host cannot cause the TCS to display Boxtype characters directly; these characters are displayed only when the host sends the Outline a Region command. If the host sends the eight-bit codes for the lower 32 characters in the extended character set, the TCS ignores the codes. If the host attempts to send the seven-bit codes for these characters using ⟨SO⟩, the TCS interprets the codes as the lower 32 characters (control characters) of the Standard Character Set. (In other words, the lower 32 characters of the Standard Character Set are not affected by ⟨SI⟩ and ⟨SO⟩.)

For a description of the Outline a Region command, including illustrations of all Boxtype characters, see the heading, Outline a Region Command, in Section 6.

ERROR CHARACTERS

The TCS displays the error characters when it detects certain types of errors.

CHARACTER DISPLAYING COMMANDS

The Character Displaying commands display and erase characters on the screen and modify their appearance. These commands affect the characters already on the screen when the command is executed.

The Character Displaying commands are:

- Display Normal Characters command (Remote)
- Display Double-Width Line command (Remote)
- Display Double-Size Line command (Remote)
- Display Normal Line command (Remote)
- Erase Character command (Remote)
- Erase in Line command (Remote)
- Erase in Display command (Remote)

These commands are described in detail in the following pages. For ease of reference, each command description begins at the top of a new page.

NOTE

Where applicable, command names are followed by the appropriate mnemonic. Mnemonics in square brackets [ ] are ANSI-specified commands. Mnemonics in braces { }are ANSI-compatible, Fluke-private commands. Mnemonics in parentheses ( ) are ANSI-compatible, DEC-private commands.

For clarity, this manual shows spaces between the characters in each control string. These spaces must be omitted when programming the TCS.

Display Normal Characters Command (Remote)

The host causes characters to appear on the screen at the cursor position (even if the cursor is invisible) whenever the host sends the characters to the TCS, unless the characters are non-printable ASCII control characters or part of a control string.

Some control characters are not displayed but affect the placement of the printable characters that follow. These control characters are known as format effectors. An example of a format effector is the Carriage Return character ⟨CR⟩. (The format effectors are all ASCII control characters.)

- If the format effectors Line Feed ⟨LF⟩, Vertical Tab ⟨VT⟩, or Form Feed ⟨FF⟩, are received when the cursor is on the bottom line of the scrolling region, the region scrolls up.
- If a Carriage Return ⟨CR⟩ is received when the New Line Mode is set and the cursor is on the bottom line of the scrolling region, then the region scrolls up.
- If any of the above mentioned format effectors are received when the cursor is on the bottom line of the screen, and the bottom line is not within the scrolling region, the screen does not scroll up.

If the TCS is set to receive eight data bits, the entire character set (except for non-printable ASCII control codes) can be displayed directly by sending the appropriate eight-bit character from the host.

If the TCS is set to receive seven data bits, the characters in the Extended Character Set cannot be displayed directly; instead, they are displayed using the Select Character Set command (⟨SO⟩ and ⟨SI⟩). The Select Character Set command is described later in this section.

NOTE

When the NOCHANGE Attribute Mode is reset ("off"), new lines appearing within the scrolling region are displayed normally (not double-sized or double-wide), with all character attributes "off". However, if the NOCHANGE Attribute Mode is set ("on"), each new line appearing within the scrolling region is displayed with the attributes of the line which just left the other side of the scrolling region. For more details, see the heading, Scrolling Region Command.

DEFAULT

Not applicable.

OPERATOR USAGE

None. (This is a remote command only.)

HOST USAGE

⟨Character⟩

⟨Character⟩ is any printable seven-bit or eight-bit character that is not part of a control string.

EXAMPLE

Hello!

The above character sequence sent from the host results in the following display:

Hello!

〈CR〉Display a string〈CR〉〈LF〉〈HT〉here!

The above character sequence sent from the host results in the following display (assuming New Line Mode is reset):

Display a string
here!

Display Double-Width Line Command (DECDWL) (Remote)

The Display Double-Width Line command displays the line occupied by the cursor (and only that line) using double-width characters.

Since each double-width character occupies twice the normal character width, all characters occupying the right half of the normal line disappear from the screen. The right half that disappears from the screen is preserved in memory and can be retrieved using the Display Normal Line command.

When a line is changed to double-width, the cursor may move horizontally across the screen in order to remain in the same character column position. If the line was originally a normal line and the cursor was past the midpoint of the line, then the cursor is repositioned to the end of the double-width line.

NOTE

This command affects both characters that were previously on the line, and those on the line that arrive after the command is issued.

DEFAULT

Not applicable.

OPERATOR USAGE

None. (This is a remote command only.)

HOST USAGE

〈ESC〉 # 6

Changes the line occupied by the cursor to appear in double-width.

Display Double-Size Line Command (DECDHL) (Remote)

The Display Double-Size Line command changes the line occupied by the cursor to appear as the bottom or top half of a double-size line. Double-size lines are both double-height and double-width.

Each double-size line must consist of two identical lines. One makes up the top half, and the other makes up the bottom half of the double-sized line. Each of the two lines that make up the double-size line is also double-width, so the characters that appeared on the right half of the screen disappear when a normal line is converted to double-size. The characters in the right half can be made to reappear when the line is restored to normal size with the Display Normal Line command.

When a line is changed to double-size, the cursor may move horizontally across the screen in order to remain in the same character column position. If the line was originally a normal line and the cursor was past the midpoint of the line, then the cursor is repositioned to the end of the double-size line.

NOTE

This command affects both the characters that were previously on the line, and those on the line that arrive after the command is issued.

DEFAULT

Not applicable.

OPERATOR USAGE

None. (This is a remote command only.)

HOST USAGE

〈ESC〉# 3

Creates the top half of the double-size line. (Changes the line occupied by the cursor to display the double-size top half of the characters currently on the line.)

〈ESC〉# 4

Creates the bottom half of the double-size line. (Changes the line occupied by the cursor to display the double-sized bottom half of the characters currently on the line.)

POSSIBLE ERRORS

If only one line is changed to double-sized, then the line contains only half (top or bottom, according to the command) of the double-sized characters that appear in the line.

Display Normal Line Command (DECSWL) (Remote)

The Display Normal Line command displays the line occupied by the cursor (and only that line) using normal characters.

To normalize a double-size line, the host must send the Display Normal Line command for both of the lines that make up the double-size line. (i.e., the top and bottom halves must both be normalized.) In many cases, after both lines have been normalized, the host should send a command to delete one of the lines, as one line usually contains exactly the same characters as the other.

If the host normalizes a double-width or double-size line, the hidden normal-sized characters that originally occupied the right-half of the line are restored. The cursor position remains in the same character column position, meaning that the cursor follows the character it resides on across the screen when the line is normalized.

DEFAULT

Not applicable.

OPERATOR USAGE

None. (This is a remote command only.)

HOST USAGE

〈ESC〉 # 5

Changes the line occupied by the cursor to appear normal sized.

Erase Character Command [ECH] (Remote)

The Erase Character command erases the character under the cursor and as many characters as desired following it up to the end of the line.

Each character erased is replaced by a blank (the ASCII Space character) with character attributes "off". The cursor does not move when the TCS executes this command.

NOTE

If the NOCHANGE Attribute Mode is set, erased characters are replaced by blanks, but their character attributes remain unchanged. This facilitates erasure within a field of attributes.

DEFAULT

The character under the cursor is erased.

OPERATOR USAGE

None. (This is a remote command only.)

HOST USAGE

⟨ESC⟩ [⟨Pn⟩ X

⟨Pn⟩ is a numeric parameter, specifying the total number of characters to be erased.

If ⟨Pn⟩ is 0 or omitted, only the character under the cursor is erased.

If ⟨Pn⟩ is n (where n is a number of characters other than zero), the character under the cursor and n-1 characters following it are erased.

POSSIBLE ERRORS

If ⟨Pn⟩ exceeds the number of characters remaining on the line to the right of the cursor, erasure does not continue beyond the end of the line (regardless of the state of the Auto Wrap-around Mode).

EXAMPLES

⟨ESC⟩ [X

Erases the character at the cursor.

⟨ESC⟩ [2 4 X

Erases the character at the cursor and the 23 characters that follow it. The cursor is not moved.

Erase in Line Command [EL] (Remote)

The Erase in Line command erases a specified section of the line occupied by the cursor.

Each character erased is replaced by a blank (the ASCII Space character) with character attributes "off". The cursor does not move when the TCS executes this command.

NOTE

If the NOCHANGE Attribute Mode is set, erased characters are replaced by blanks, but their character attributes remain unchanged. This facilitates erasure within a field of attributes. The line type remains unchanged regardless of the state of the NOCHANGE Attribute Mode.

DEFAULT

The line is erased from the cursor through the end of the line (inclusive).

OPERATOR USAGE

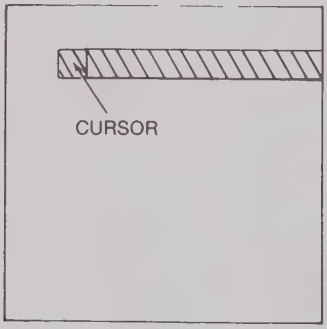
None. (This is a remote command only.)

HOST USAGE

⟨ESC⟩ [⟨Ps⟩ K

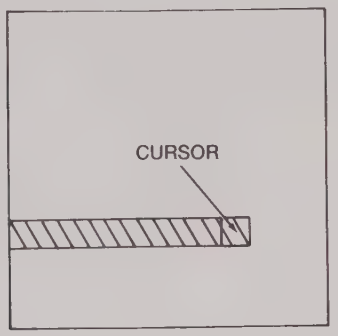
⟨Ps⟩ is a selective parameter, specifying the portion of the current line to be erased.

If ⟨Ps⟩ is 0 or is omitted, characters from the cursor through the end of the line are erased.



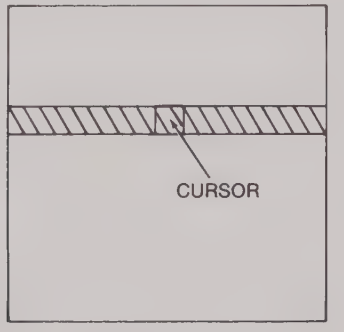
⟨Ps⟩ = 0
ERASED FROM CURSOR THROUGH END OF LINE

If ⟨Ps⟩ is 1, characters from the start of the line through the cursor are erased.



⟨Ps⟩ = 1
ERASED FROM BEGINNING OF LINE THROUGH CURSOR

If ⟨Ps⟩ is 2, the entire line is erased.



⟨Ps⟩ = 2
ERASED ENTIRE LINE

EXAMPLES

⟨ESC⟩ [K

Erases from the cursor through the end of the line. The cursor is not moved.

⟨ESC⟩ [2 K

Erases the entire line. The cursor is not moved.

Erase in Display Command [ED] (Remote)

The Erase in Display command erases all or part of the display.

This command can be used to erase the area preceding the cursor, the area following the cursor, or the entire screen. Each erased character is replaced by a blank (the ASCII Space character) with character attributes "off". The cursor does not move when this command is executed.

If the entire screen is erased, all line types are reset to normal. If a portion of the screen (preceding or following the cursor) is erased, all completely erased lines are reset to normal. The line type of the line occupied by the cursor is only partially erased and remains unchanged.

NOTE

When the NOCHANGE Attribute Mode is set, erased characters are replaced by blanks, but the character attributes within the erased area remain unaffected. This facilitates erasure within a field of attributes.

DEFAULT

Characters are erased from the cursor through the end of the screen (inclusive).

OPERATOR USAGE

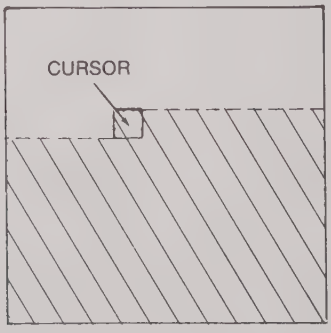
None. (This is a remote command only.)

HOST USAGE

⟨ESC⟩ [⟨Ps⟩ J

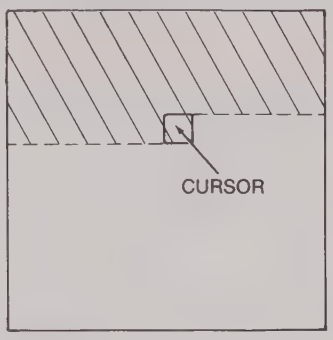
⟨Ps⟩ is a selective parameter, specifying the portion of the screen to be erased.

If ⟨Ps⟩ is 0 or omitted, characters from the cursor through the end of the screen (inclusive) are erased.



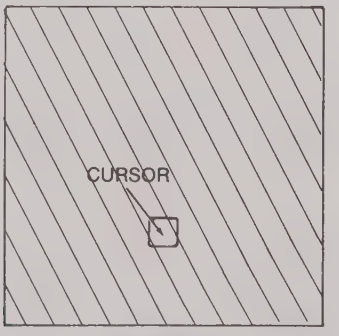
⟨Ps⟩ = 0
ERASED FROM CURSOR THROUGH END OF SCREEN

If ⟨Ps⟩ is 1, characters from the beginning of the screen through the cursor position (inclusive) are erased.



⟨Ps⟩ = 1
ERASED FROM BEGINNING OF SCREEN THROUGH CURSOR

If ⟨Ps⟩ is 2, the entire screen is erased.



⟨Ps⟩ = 2
ERASED ENTIRE SCREEN

EXAMPLES

⟨ESC⟩ [J

Erases from the cursor through the end of the screen. The cursor does not move.

⟨ESC⟩ [1 J

Erases from the beginning of the screen through the cursor position.

CHARACTER INTERPRETATION COMMANDS

Character Interpretation commands determine the appearance and placement of characters that arrive after the command is received. The Character Interpretation commands are:

- Auto Wrap-Around Mode command (Local/Remote)
- Send-Receive Mode command (Local/Remote)
- New Line Mode command (Local/Remote)
- Select Character Set command (Remote)
- NOCHANGE Attribute Mode command (Local/Remote)
- National Replacement Code command (Local/Remote)
- Set Character Attributes command (Remote)
- Scrolling Region command (Remote)
- Origin Mode command (Remote)

These commands are described in detail in the following pages. For ease of reference, each command description begins at the top of a new page.

NOTE

Where applicable, command names are followed by the appropriate mnemonic. Mnemonics in square brackets [ ] are ANSI-specified commands. Mnemonics in braces { } are ANSI-compatible, Fluke-private commands. Mnemonics in parentheses ( ) are ANSI-compatible, DEC-private commands.

For clarity, this manual shows spaces between the characters in each control string. These spaces must be omitted when programming the TCS.

Auto Wrap-Around Mode Command (DECAWM) (Local/Remote)

The Auto Wrap-Around Mode command sets and resets the Auto Wrap-Around Mode.

The Auto Wrap-Around Mode determines how the cursor responds when the TCS receives characters that run off the right margin of the display.

- When the Auto Wrap-Around Mode is "off" (reset), a character received when the cursor is at the right margin replaces the previously displayed character and the cursor remains stationary.

- When the Auto Wrap-Around Mode is "on" (set), another character received (other than the tab character ⟨HT⟩) after a character had already been placed at the right margin is displayed on the next line at the left margin. This causes the screen to scroll if the new line would be below the bottom of the scrolling region. The tab character ⟨HT⟩ never moves the cursor to the next line.

DEFAULT

Off (Reset).

OPERATOR USAGE

The user sets the Auto Wrap-Around Mode by entering the Setup Screen and, using touchkeys or the optional keyboard, setting the Auto-Wrap parameter to one of the following states:

- off (reset)

- on (set)

HOST USAGE

⟨ESC⟩ [? 7 l

Resets the Auto Wrap-Around Mode to "off."

⟨ESC⟩ [? 7 h

Sets the Auto Wrap-Around Mode to "on."

Send-Receive Mode Command [SRM] (Local/Remote)

The Send-Receive Mode command sets and resets the Send-Receive Mode, which controls the Local Echo feature of the TCS. The Local Echo feature echoes user input from the optional keyboard to the TCS. Touch cell reports and other TCS-to-host strings are not affected (and are never echoed locally).

- When the Send-Receive Mode is reset, the Local Echo feature is turned on. User input from the keyboard is sent to both the host and the TCS; the TCS interprets the input as if it had been sent (echoed) by the host. This relieves the host from the burden of echoing characters to the TCS.

- When the Send-Receive Mode is set, the Local Echo feature is turned off. User input from the keyboard is sent only to the host; the input is not interpreted by the TCS. The host may, at its own discretion, echo the input back to the TCS.

The user may set or reset the Send-Receive Mode by setting the Local Echo parameter within the Setup Screen to "off" or "on", respectively.

NOTE

The Send-Receive Mode and the Local Echo parameter both control the Local Echo feature. However, they operate as opposites. That is, the Local Echo feature is off when the Local Echo parameter is "off" and the Send-Receive Mode is set. Likewise, the Local Echo feature is on when the Local Echo parameter is "on" and the Send-Receive Mode is reset.

DEFAULT VALUE

Set. (Local Echo feature is off.)

OPERATOR USAGE

The user sets or resets the Send-Receive Mode (and thus the Local Echo feature) by entering the Setup Screen and setting the Local Echo parameter to one of the following values:

- on (Local Echo feature is on and Send-Receive Mode is reset.)

- off (Local Echo feature is off and Send-Receive Mode is set.)

HOST USAGE

〈ESC〉[1 2 l

Resets the Send-Receive Mode (Local Echo is "on").

〈ESC〉[1 2 h

Sets the Send-Receive Mode (Local Echo is "off").

New Line Mode Command [LNM] (Local/Remote)

The New Line Mode command determines which control character(s) are transmitted by the TCS when the Return key or (if the auxiliary keypad is in the Numeric Mode) when the Enter key is pressed on the optional keyboard. The New Line Mode command also determines the action taken by the TCS when it receives Line Feed ⟨LF⟩, Form Feed ⟨FF⟩, and Vertical Tab ⟨VT⟩ characters.

The effect of the New Line Mode on the Return, Enter, and Ctrl/M keys is shown in Table 5-1. The effect of the New Line Mode on cursor movement is shown in Table 5-2.

Table 5-1. Effects of the New Line Mode on the Return and Enter Keys

KEYBOARD INPUT	CHARACTERS SENT TO THE HOST	
	New Line off	New Line on
Return	TCS sends ⟨CR⟩	TCS sends ⟨CR⟩⟨LF⟩
Enter*	TCS sends ⟨CR⟩	TCS sends ⟨CR⟩⟨LF⟩
⟨Ctrl/M⟩	TCS sends ⟨CR⟩	TCS sends ⟨CR⟩ ⟨LF⟩
*When keypad is in numeric mode		

Table 5-2. Efects of the New Line Mode on Cursor Movement

HOST OUTPUT	RESULTING CURSOR MOVEMENT	
	New Line off	New Line on
⟨LF⟩, ⟨FF⟩, or ⟨VT⟩	Moves cursor to next line, same column.	Moves cursor to next line, left margin.

DEFAULT

Off (reset).

OPERATOR USAGE

The user sets or resets the New Line Mode by entering the Setup Screen and, using touchkeys or the optional keyboard, setting the New Line parameter to one of the following values:

- on (Sets New Line Mode)
- off (Resets New Line Mode.)

HOST USAGE

⟨ESC⟩ [2 0 l

Resets New Line Mode to "off".

⟨ESC⟩ [2 0 h

Sets New Line Mode to "on".

Select Character Set Command [SCS] (Remote)

The Select Character Set command provides the mechanism for addressing the Extended Character Set when the serial interface is set to operate with only seven data bits.

When seven data bits are used, the Standard Character Set and the Extended Character Set are both represented by the codes 0 through 127, decimal (0 though 7F, hex). The host shifts (selects) between the two character sets by sending the Select Character Set command.

In order to address the Extended Character Set with a seven-bit code, the host:

1. Sends the Shift Out character ⟨SO⟩ (14 decimal, E hex) to select the Extended Character Set.

2. Sends the seven-bit code for each desired character. The TCS converts each seven-bit code to an eight-bit code by appending a "1" as the most significant bit, making an Extended Character available for display.

3. Sends the Shift In character ⟨SI⟩ (15 decimal, F hex) to return to the Standard Character Set. The TCS interprets any subsequent seven-bit codes as characters from the Standard Character set.

Once the TCS has received an ⟨SO⟩, the TCS interprets subsequent characters (except ASCII control characters) as Extended Characters until the TCS receives an ⟨SI⟩.

NOTE

ASCII control characters are not affected by this command.

Once the TCS has received an ⟨SO⟩ from the host, additional ⟨SO⟩ characters are ignored until an ⟨SI⟩ is received. That is, it is permissible to send several ⟨SO⟩ characters without an intervening ⟨SI⟩, or several ⟨SI⟩ characters without an intervening ⟨SO⟩. In either case, the host is merely reselecting the character set already in use. When the Extended Character set is selected, the National Replacement Code command has no affect.

DEFAULT

The Standard Character set is selected.

OPERATOR USAGE

None. (This is a remote command only.)

HOST USAGE

⟨SO⟩ (Shift Out, 14 decimal, E hex)

Selects the Extended Character Set.

⟨SI⟩ (Shift In, 15 decimal, F hex)

Selects the Standard Character Set.

POSSIBLE ERRORS

When the Extended Character Set is selected, this command has priority over any National Replacement Code (NRC) which may be in effect. Characters will be shifted-out to the Extended Character Set and will not be affected by the NRC.

When ⟨SO⟩ is in effect and eight-bit codes are received, the most-significant bit is replaced with a "1". This has the effect of mapping eight-bit Standard Characters into eight-bit Extended Characters, while leaving eight-bit Extended Characters effectively unchanged.

EXAMPLES

⟨SI⟩ 1 2 3 A 4 5 ⟨SO⟩ 1 2 3 A 4 5 ⟨SI⟩

This sequence displays the following characters from the Standard Character Set:

31, 32, 33, 41, 34 and 35 (hex)

and then displays the following characters from the Extended Character set:

B1, B2, B3, C1, B4, and B5 (hex).

NOCHANGE Attribute Mode Command {FNCAM} (Remote)

The NOCHANGE Attribute Mode command sets and resets the NOCHANGE Attribute Mode.

The NOCHANGE Attribute Mode command allows the host to modify the character contents within an area of the display without affecting visual attributes (i.e., character attributes and/or line type) already in use in the area.

When set, the NOCHANGE Attribute Mode prevents commands that indirectly change the visual attributes of an area from taking affect. However, commands that directly call for changes in visual attributes override the NOCHANGE attribute Mode.

Commands that are affected by the NOCHANGE Attribute Mode are listed in Table 5-3.

If the host sends a command specifically calling for a change in visual attributes, that command will take effect regardless of the state of the NOCHANGE Attribute Mode. Commands that are unaffected by the NOCHANGE Attribute Mode are listed in Table 5-4.

DEFAULT

Reset.

OPERATOR USAGE

None. (This is a remote command only.)

HOST USAGE

〈ESC〉[〉3 l

Resets NOCHANGE Attribute Mode.

〈ESC〉[〉3 h

Sets NOCHANGE Attribute Mode.

EXAMPLE

The following sequence illustrates a typical use of the NOCHANGE Attribute Mode:

1. The host sends the Set Character Attributes command to select highlighted characters, then sends the message, "WARNING . . . HEAT RISING". The message is displayed in highlighted characters.
2. The host sends the Set Character Attributes comn and to select new character attributes (e.g., normal attributes), then sen s a less important message for display elsewhere on the screen, using the new ttributes.
3. The host sets the NOCHANGE Attribute Mode.
4. Now the host replaces the earlier warning message with the new message, "DANGER . . . OVER LIMIT". The new message is displayed with the same attributes as the previous warning message (i.e., highlighted).

The host can continue to update the various messages on the screen using their previous character attributes without having to send the Set Character Attributes command each time.

Table 5-3. Commands Affected by NOCHANGE Attribute Mode

COMMAND	OPERATION OF COMMAND WHEN NOCHANGE ATTRIBUTE MODE IS REST (OFF)	OPERATION OF COMMAND WHEN NOCHANGE ATTRIBUTE MODE IS SET (ON)
Characters sent for display	Characters are displayed.	Characters are displayed.
	Character attributes are determined by the Set Character Attributes command.	Character positions retain previous attributes.
Erase Character	Characters are erased.	Characters are erased.
	Character attributes turned off.	Character positions retain previous attributes.
Erase in Line	Characters are erased.	Characters are erased.
	Character attributes turned off.	Character positions retain previous attributes.
Erase in Display	Characters are erased.	Characters are erased.
	Character attributes turned off.	Character positions retain previous attributes.
	Lines may have their line types reset to normal.	Line types are unaffected.
Scrolling	New lines scrolling into a region have a line type of normal, their character attributes turned off, and their character contents erased.	New lines scrolling into a region have their character contents erased but their line type and character attributes match those of the line that just scrolled out of the region.
Erase a Region	Characters are erased.	Characters are erased.
	Character attributes are turned off.	Character positions retain previous attributes.
Outline a Region	Characters are replaced.	Characters are replaced.
	Character attributes are replaced using current character attributes selected.	Character positions retain previous attributes.

Table 5-4. Commands Unaffected by NOCHANGE Attribute Mode

COMMAND	ACTIONS CAUSED REGARDLESS OF THE NOCHANGE ATTRIBUTE MODE SETTING
Screen Background Mode	The character foreground and background appear reversed from previous state.
Display Normal Line	The line type is changed to normal.
Display Double-Width Line	The line type is changed to double width.
Display Double-Size Line	The line type is changed to double-size.
Modify Character Attributes in a Region	Character attributes are changed.

National Replacement Code Command {FNRC} (Local/Remote)

The National Replacement Code (NRC) command lets the user or host substitute a designated set of international characters in place of some standard ASCII characters on the display.

This command allows text containing characters unique to one of 11 languages to be displayed and manipulated without a special keyboard or eight-bit character codes. Table 5-5 shows the available character sets and the characters that are replaced.

The NRC command selects a value for the NRC parameter.

- When the NRC parameter is "off", characters sent from the host are directly mapped to the Standard (ASCII) Character Set.
- When the NRC parameter is set to a country designator, some characters sent from the host for display are remapped using the National Replacement Code specified by the NRC value.

The NRC selection only affects the TCS display, not the communication between TCS and the host. International characters are substituted only on the display, not in the data transmitted between the TCS and the host.

For example, after setting the NRC value to "German", the user can create a text file containing standard ASCII characters. When this file is displayed with the NRC set to "German", the appropriate German characters are displayed. However, if the same file is viewed with the NRC set to "off", the displayed international characters which were peculiar to the German NRC appear as standard ASCII symbolic characters; for example, an "a umlaut" (ä) is displayed as a left-brace ({).

NOTE

A change to the NRC only affects the characters received after the NRC is changed.

DEFAULT

Off.

OPERATOR USAGE

The user selects the National Replacement Code by entering the Setup Screen and, using touchkeys or the optional keyboard, setting the NRC parameter to one of the following values:

- off
- Danish
- Dutch
- French
- Canadian
- Finnish
- German
- Italian

- Spanish
- Swedish
- Swiss
- UK

HOST USAGE

⟨ESC⟩ [4 ; ⟨Ps⟩ z

⟨Ps⟩ is the NRC selective parameter.

If ⟨Ps⟩ is 0 or omitted, NRC is "off".

If ⟨Ps⟩ is 1, NRC is Danish.

If ⟨Ps⟩ is 2, NRC is Dutch.

If ⟨Ps⟩ is 3, NRC is French.

If ⟨Ps⟩ is 4, NRC is Canadian.

If ⟨Ps⟩ is 5, NRN is Finnish.

If ⟨Ps⟩ is 6, NRC is German.

If ⟨Ps⟩ is 7, NRC is Italian.

If ⟨Ps⟩ is 8, NRC is Spanish.

If ⟨Ps⟩ is 9, NRC is Swedish.

If ⟨Ps⟩ is 10, NRC is Swiss.

If ⟨Ps⟩ is 11, NRC is UK.

POSSIBLE ERRORS

If the Extended Character Set is selected by the Select Character Set command, characters will be shifted-out to the Extended Character Set and will not be affected by the NRC. The NRC only operates on input characters when the Select Character Set command is selecting the Standard Character Set.

EXAMPLES

⟨ESC⟩ [4 ; 7 z

Sets the NRC to Italian.

⟨ESC⟩ [4 z

Sets the NRC to "off". (No replacements are made.)

⟨ESC⟩ [4 ; 1 1 z

Sets the NRC to UK.

Table 5-5. National Replacement Code Characters

NATIONALITY	CHARACTER RECEIVED	CHARACTER DISPLAYED	DESCRIPTION OF DISPLAYED CHARACTER
Danish	@	Ä	A umlaut
	]	Å	A ring
	[	Æ	A E ligature
	\	Ø	O slash
	^	Ü	U umlaut
	`	ä	a umlaut
	}	å	a ring
	{	æ	a e ligature
	|	ø	o slash
	~	ü	u umlaut
Dutch	#	£	pound symbol
	@	¾	fraction 3/4
	[	ij	i j ligature
	\	½	fraction 1/2
	]	¦	vertical bar
	{	¨	umlaut (bare)
	|	*f*	script f
	}	¼	fraction 1/4
	~	'	single quote
French	#	£	pound symbol
	]	§	section sign
	[	°	degree sign
	@	à	a grave
	\	ç	c cedilla
	}	è	e grave
	{	é	e acute
	|	ù	u grave
	~	¨	umlaut (bare)
Canadian	@	à	a grave
	[	â	a circumflex
	\	ç	c cedilla
	}	è	e grave
	|	é	e acute
	]	ê	e circumflex
	^	î	i circumflex
	`	ô	o circumflex
	¦	ù	u grave
	~	û	u circumflex

Table 5-5. National Replacement Code Characters (cont)

NATIONALITY	CHARACTER RECEIVED	CHARACTER DISPLAYED	DESCRIPTION OF DISPLAYED CHARACTER
Finnish	[	Ä	A umlaut
	]	Å	A ring
	\	Ö	O umlaut
	^	Ü	U umlaut
	{	ä	a umlaut
	}	å	a ring
	`	è	e grave
	¦	ö	o umlaut
	~	ü	u umlaut
German	@	§	section sign
	[	Ä	A umlaut
	\	Ö	O umlaut
	]	Ü	U umlaut
	~	ß	German small sharp s
	{	ä	a umlaut
	¦	ö	o umlaut
	}	ü	u umlaut
Italian	#	£	pound symbol
	@	§	section sign
	[	°	degree sign
	~	ì	i grave
	{	à	a grave
	\	ç	c cedilla
	}	è	e grave
	]	é	e acute
	¦	ò	o grave
	`	ù	u grave
Spanish	#	£	pound symbol
	[	¡	inverted !
	@	§	section sign
	{	°	degree sign
	]	¿	inverted ?
	\	Ñ	N tilde
	}	ç	c cedilla
		ñ	n tilde
Swedish	@	È	E grave
	[	Ä	A umlaut
	]	Å	A ring
	\	Ö	O umlaut
	^	Ü	U umlaut
	{	ä	a umlaut
	}	å	a ring
	`	è	e grave
	~	ö	o umlaut
		ü	u umlaut

Table 5-5. National Replacement Code Characters (cont)

NATIONALITY	CHARACTER RECEIVED	CHARACTER DISPLAYED	DESCRIPTION OF DISPLAYED CHARACTER
Swiss	@	à	a grave
	{	ä	a umlaut
	\	ç	c cedilla
		è	e grave
	[	é	e acute
	]	ê	e circumflex
	^	î	i circumflex
	`	ô	o circumflex
	|	ö	o umlaut
	~	û	u circumflex
	}	ü	u umlaut
UK	#	£	pound symbol

Set Character Attributes Command [SGR] (Remote)

The Set Character Attributes command selects the visual attributes for displayed characters.

After the Set Character Attributes command has been sent, characters received by the TCS are displayed with the selected attributes unless the NOCHANGE Attribute Mode is set. If scrolling causes characters to move, the characters' attributes move with them, regardless of where the characters are placed on the screen.

One or more attributes may be changed at a time. Changing an attribute does not turn off the other attributes already selected. An attribute may be turned on or off individually, or all attributes may be turned off at once.

The TCS can display characters with the following attributes:

- Highlight

  The character is displayed with increased intensity.

- Underline

  The character is underlined.

- Blink

  The character blinks on or off every 1.07 seconds (when the Refresh Rate is 60 Hz) or every 1.28 seconds (when the Refresh Rate is 50 Hz) with a 50% duty cycle.

  NOTE

  A 50% duty cycle means that the character is "on" half of the time.

- Reverse-Video

  The character cell foreground matches the screen background, and the character cell background matches the screen foreground.

DEFAULT

All attributes are turned off.

OPERATOR USAGE

None. (This is a remote command only.)

HOST USAGE

⟨ESC⟩ [⟨Ps⟩ ; ... ; ⟨Ps⟩ m

⟨Ps⟩ is a selective parameter, designating the character attribute(s).

If ⟨Ps⟩ is 0 or omitted, all attributes are turned off.

If ⟨Ps⟩ is 1, highlight.

If ⟨Ps⟩ is 4, underline.

If ⟨Ps⟩ is 5, blink.

If ⟨Ps⟩ is 7, reverse-video.

If ⟨Ps⟩ is 2 2, turn off highlight.

If ⟨Ps⟩ is 2 4, turn off underline.

If ⟨Ps⟩ is 2 5, turn off blink.

If ⟨Ps⟩ is 2 7, turn off reverse-video.

NOTE

The parameter values may be combined to select multiple character attributes with a single control string (see examples, below). Invalid selective parameters are ignored.

POSSIBLE ERRORS

If the host asks for two or more incompatible character attributes in the same control string (such as "blink" followed by "turn off blink") the last character attribute ("turn off blink") takes precedence.

EXAMPLES

⟨ESC⟩ [7 ; 5 m

Select reverse-video and blink attributes in addition to the previous attributes.

⟨ESC⟩ [m

Turn all video attributes off. Characters received after this command are displayed normally.

Scrolling Region Command (DECSTBM) (Remote)

The Scrolling Region command limits scrolling to a portion of the screen.

This feature is useful when one area of the screen must display immobile objects (such as touch targets) while another area of the screen displays scrolling information.

A scrolling region is designated by specifying the top and bottom lines of the region. The minimum size of a scrolling region is two lines. When specifying a scrolling region, the line number of the top must be less than the line number of the bottom. (Lines on the TCS screen are consecutively numbered from top to bottom.)

The scrolling region specifies which portion of the screen may scroll and the area within which relative cursor movements are limited.

NOTE

Once inside the scrolling region, relative cursor commands cannot cause the cursor to leave the scrolling region. Only the Move Cursor to Absolute Position command can move the cursor out of the scrolling region (and then only when Origin Mode is reset). When the Origin Mode is set, the cursor can never leave the scrolling region, even with a Move Cursor to Absolute Position command. See the discussion of the Origin Mode command in this section.

If a scrolling region is specified while the Origin Mode is reset, the cursor moves to the home position (column 1, line 1) of the screen. If a scrolling region is specified while the Origin Mode is set, the cursor moves to the home position of the scrolling region (column 1 of the top line of the scrolling region).

Normally, when a line scrolls out of a scrolling region, its characters disappear, its line type reverts to normal, its character attributes are set to "off", and it reappears as the new line on the other end of the scrolling region. However, if the NOCHANGE Attribute Mode is set, when a line scrolls out of a scrolling region, only the characters disappear; the line type and character attributes of the line remain unchanged when the line reappears (as a new line) at the other end of the scrolling region. This allows character attributes and line types of each line within a scrolling region to be preserved throughout scrolling operations.

DEFAULT

The top line of the scrolling region defaults to line 1.

The bottom line of the scrolling region defaults to line 24.

OPERATOR USAGE

None. (This is a remote command only.)

HOST USAGE

⟨ESC⟩ [⟨Pt⟩ ; ⟨Pb⟩ r

⟨Pt⟩ is a numeric parameter, designating the top line of the scrolling region. If ⟨Pt⟩ is omitted or 0, the top line of the scrolling region is set to line 1.

⟨Pb⟩ is a numeric parameter, designating the bottom line of the scrolling region. If ⟨Pb⟩ is omitted or 0, the bottom line of the scrolling region is set to 24.

NOTE

If ⟨Pb⟩ is less than or equal to ⟨Pt⟩, the command is ignored.

EXAMPLES

⟨ESC⟩ [5 ; 2 0 r

Changes the scrolling region to be from line 5 through line 20, inclusive.

⟨ESC⟩ [r

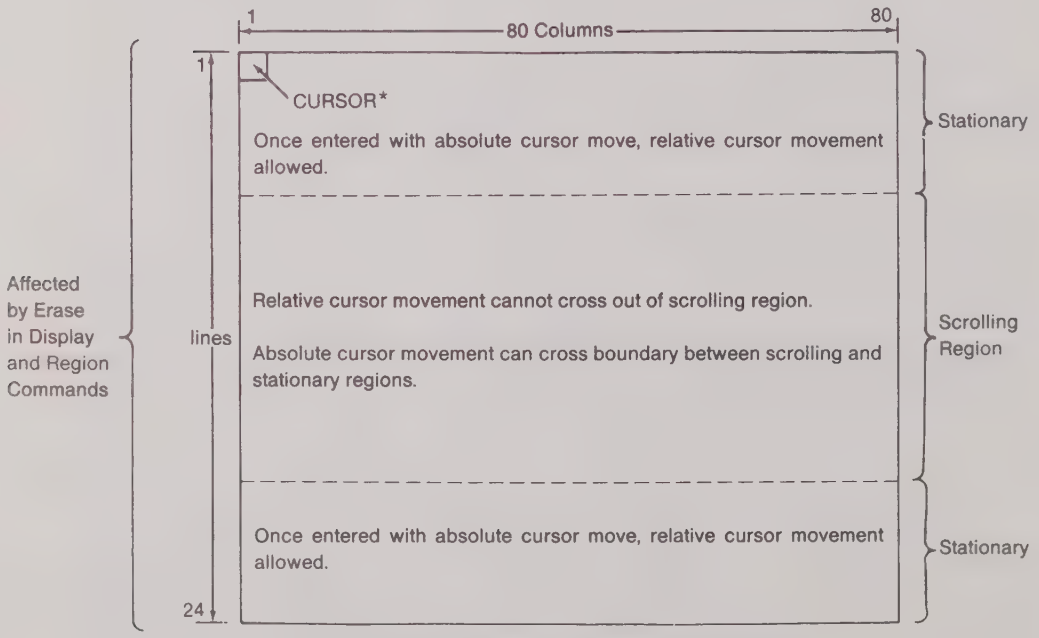
Changes the scrolling region to be the entire screen (line 1 through line 24, inclusive).

Origin Mode Command (DECOM) (Remote)

The Origin Mode command sets or resets the Origin Mode. The Origin Mode performs three functions: it determines whether the lines of the screen are numbered relative to the screen as a whole or relative only to the scrolling region; whether the cursor can be moved out of the scrolling region; and whether the Erase in Display and Region commands affect the entire screen or only the scrolling region. (Also see the discussion under the heading, "Scrolling Region Command".)

When Origin Mode is reset (off):

- Line numbering begins with line 1 at the top of the screen and continues through line 24 at the bottom of the display.
- The cursor may be moved out of the scrolling region, but only by a Move Cursor to Absolute Position command sent by the host. (See the heading, Move Cursor to Absolute Position Command, later in this section.)
- The Erase in Display command and Region commands affect the entire screen.
- The cursor is moved to the absolute home position of the entire display. The home position is at the upper-left character position of the screen.


1
80 Columns
80
1
CURSOR*
Once entered with absolute cursor move, relative cursor movement allowed.
Stationary
Affected by Erase in Display and Region Commands
lines
Relative cursor movement cannot cross out of scrolling region.
Absolute cursor movement can cross boundary between scrolling and stationary regions.
Scrolling Region
Once entered with absolute cursor move, relative cursor movement allowed.
Stationary
24

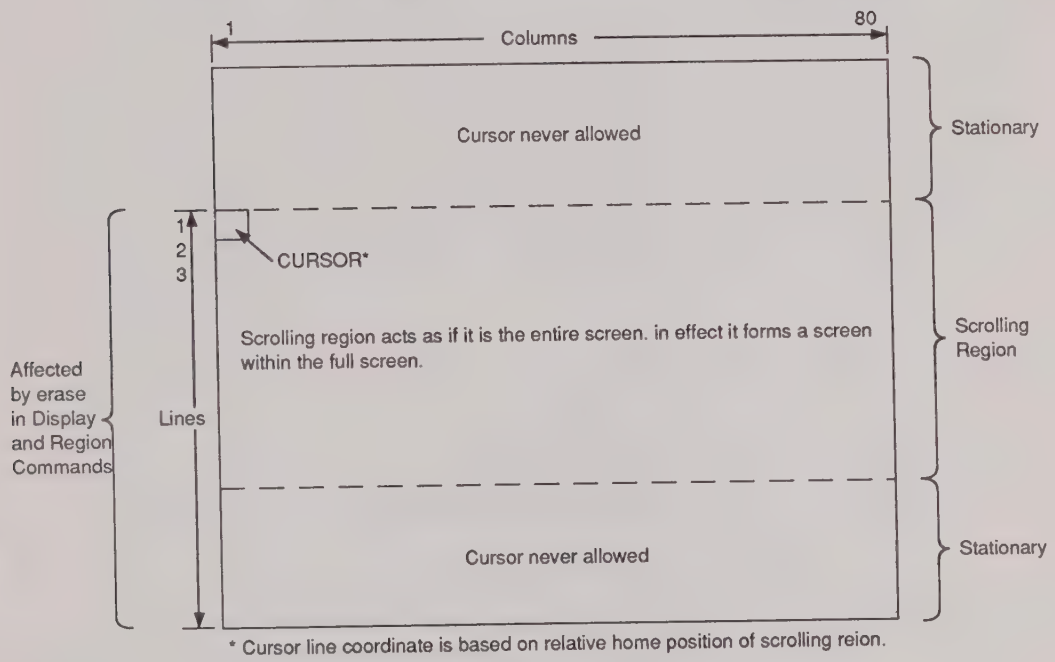
* Cursor line coordinate is based on absolute home position.

ORIGIN MODE RESET

When the Origin Mode is set (on):

- Line numbering begins with line 1 at the top of the scrolling region and continues through the bottom of the scrolling region.
- The cursor cannot be moved out of the scrolling region.

- The Erase in Display command and Region commands affect only the scrolling region.
- The cursor is moved to the home position relative to the scrolling region. The home position is the upper-left character position within the scrolling region.



ORIGIN MODE SET

When the Origin Mode is set, the scrolling region can, in effect, becomes a smaller independent screen within the entire screen. Host software may treat the scrolling region as an independent screen without regard for those areas outside of the region. This technique is useful when the host software operating within the scrolling region may not be aware of touch targets drawn above or below the region. Since erasure and Region commands cannot extend out of the scrolling region, any data or targets previously placed outside the region cannot be modified (unless Origin Mode is explicitly reset).

DEFAULT

Reset ("off").

OPERATOR USAGE

None. (This is a remote command only.)

HOST USAGE

〈ESC〉[?6l

Resets the Origin Mode.

〈ESC〉[?6h

Sets the Origin Mode.

CURSOR COMMANDS

The Cursor commands determine the appearance and/or location of the cursor. The cursor commands are:

- Move Cursor to Absolute Position command (Remote)
- Move Cursor Forward command (Remote)
- Move Cursor Backward command (Remote)
- Move Cursor Up command (Remote)
- Move Cursor Down command (Remote)
- Next Line command (Remote)
- Index command (Remote)
- Reverse Index command (Remote)
- Read Cursor Position command (Remote)
- Read Character Under Cursor command (Remote)
- Read Attributes Under Cursor command (Remote)
- Cursor Type command (Local/Remote)

These commands are described in detail in the following pages. For ease of reference, each command description begins at the top of a new page.

NOTE

Where applicable, command names are followed by the appropriate mnemonic. Mnemonics in square brackets [ ] are ANSI-specified commands. Mnemonics in braces { } are ANSI-compatible, Fluke-private commands. Mnemonics in parentheses ( ) are ANSI-compatible, DEC-private commands.

For clarity, this manual shows spaces between the characters in each control string. These spaces must be omitted when programming the TCS.

Move Cursor to Absolute Position Command [CUP] (Remote)

The Move Cursor to Absolute Position command moves the cursor to an absolute character position on the screen, specified in lines and columns.

The maximum number of lines is 24. On a normal line, the maximum number of columns is 80; on a double-wide or double-size line, the number of columns is 40.

NOTE

Lines are numbered from top to bottom. Columns are numbered from left to right.

The absolute cursor position may appear at different physical locations on the screen, depending on whether the Origin Mode is set or reset.

If the Origin Mode is reset:

- The line number specified by this command is relative to the first line of the screen.

If the Origin Mode is set:

- The line number specified by this command is relative to the first line of the scrolling region.
- The cursor cannot be moved outside the scrolling region with this command. If an attempt is made to move the cursor to an absolute position outside the scrolling region, the cursor stops at the edge of the scrolling region.

DEFAULT

If the Origin Mode is set, the cursor location defaults to the home position of the scrolling region (that is, the upper-left corner of the scrolling region.)

If the Origin Mode is reset, the cursor location defaults to the home position of the screen as a whole.

OPERATOR USAGE

None. (This is a remote command only.)

HOST USAGE

⟨ESC⟩ [⟨Pl⟩ ; ⟨Pc⟩ H

⟨Pl⟩ is a numeric parameter, designating a line number.

If ⟨Pl⟩ is 0 or omitted, the cursor moves to the first line.

If ⟨Pl⟩ is n (where n is a number between 1 and 24 inclusive), the cursor moves to line n.

If ⟨Pl⟩ is greater than 24, the cursor moves to the last line.

⟨Pc⟩ is the numeric parameter, designating a column number.

If ⟨Pc⟩ is 0 or omitted, the cursor moves to the first column.

If ⟨Pc⟩ is n (where n is a number between 1 and 80), the cursor moves to column n.

If ⟨Pc⟩ is greater than 80, the cursor moves to the last column.

If ⟨Pc⟩ is greater than 40 and the line is double-width or double-size, the cursor moves to the last column.

EXAMPLES

⟨ESC⟩ [H

Moves the cursor home (line 1, column 1).

⟨ESC⟩ [5 ; 0 6 2 H

Moves the cursor to line 5, column 62.

⟨ESC⟩ [2 4 H

Moves the cursor to line 24, column 1.

⟨ESC⟩ [; 30 H

Moves the cursor to line 1, column 30.

⟨ESC⟩ [30 H

Moves the cursor to line 24, column 1. (⟨Pl⟩ is greater than 24 therefore, the cursor moves to the last line on the screen.)

Move Cursor Forward Command [CUF] (Remote)

The Move Cursor Forward command is a relative cursor movement command. It moves the cursor forward (towards the right) without affecting its vertical position.

The cursor cannot be moved beyond the right margin of the screen by this command. The cursor remains at the right margin and does not move to another line, even if the Auto Wrap-Around Mode is set ("on").

There are 40 character positions in a double-width or double-size line and 80 in a normal line.

DEFAULT

The cursor moves one character forward.

OPERATOR USAGE

None. (This is a remote command only.)

HOST USAGE

⟨ESC⟩ [⟨Pn⟩ C

⟨Pn⟩ is a numeric parameter, designating the number of characters to move.

If ⟨Pn⟩ is 0 or omitted, the cursor moves forward (right) one character.

If ⟨Pn⟩ is greater than 0, the cursor moves forward (right) ⟨Pn⟩ characters.

POSSIBLE ERRORS

If ⟨Pn⟩ is greater than the number of columns to the right of the cursor position, the cursor is moved only as far as the right margin of the current line. If an attempt is made to move the cursor forward past the right margin of the current line, the cursor does not move to another line.

EXAMPLES

⟨ESC⟩ [C

Moves the cursor forward (right) one character position.

⟨ESC⟩ [0 6 2 C

Moves the cursor forward (right) 62 character positions, or to the right margin of the screen if it is less than 62 characters to the margin.

Move Cursor Backward Command [CUB] (Remote)

The Move Cursor Backward command is a relative cursor movement command. It moves the cursor backward (left) on the screen without affecting its vertical position.

The cursor cannot be moved beyond the left margin of the current line with this command. The cursor will not move to the line above it.

There are 40 character positions in a double-width or double-size line and 80 in a normal line.

DEFAULT

The cursor moves one character backward.

OPERATOR USAGE

None. (This is a remote command only.)

HOST USAGE

⟨ESC⟩ [⟨Pn⟩ D

⟨Pn⟩ is a numeric parameter, designating the number of characters to move.

If ⟨Pn⟩ is 0 or omitted, the cursor moves backward (left) one character.

If ⟨Pn⟩ is greater than 0, the cursor moves backward (left) ⟨Pn⟩ characters.

POSSIBLE ERRORS

If ⟨Pn⟩ is greater than the number of columns to the left of the cursor position, the cursor is moved only as far as the left margin of the current line. The cursor does not move to another line when an attempt is made to move it beyond the left margin of the current line.

EXAMPLES

⟨ESC⟩ [D

Moves the cursor backward (left) one character position.

⟨ESC⟩ [0 2 9 D

Moves the cursor backward (left) 29 character positions. If less than 29 character positions remain to the left margin of the current line, the cursor moves to the left margin of the screen and stops.

Move Cursor Up Command [CUU] (Remote)

The Move Cursor Up command is a relative cursor movement command. It moves the cursor up the screen without affecting its column position.

Once the cursor enters a scrolling region, the cursor cannot be moved outside the scrolling region with a relative cursor movement command. The cursor stops at the edge of the scrolling region and the region is not scrolled. However, if the cursor is already outside the scrolling region, this command can move the cursor until it reaches the top edge of the screen.

When the cursor reaches the top line of the screen, the cursor cannot be moved any farther by this command. The cursor remains on the top line, and the screen is not scrolled when an attempt is made to move the cursor past the top line.

When the cursor is moved between normal lines and double-width or double-size lines, the cursor moves across the screen horizontally as well as vertically. This is because the cursor follows character column positions, which are in different physical locations on the screen for normal and double-width (or double-size) lines. (Double-width and double-size lines are 40 columns wide, and normal lines are 80 columns wide.) For example, as the cursor moves between column 40 on a double-size line and column 40 on a normal line, the cursor's physical position jumps from the right margin of the screen on the double-size line to the center of the screen on the normal line.

DEFAULT

The cursor moves one line up.

OPERATOR USAGE

None. (This is a remote command only.)

HOST USAGE

⟨ESC⟩ [⟨Pn⟩ A

⟨Pn⟩ is numeric parameter, designating the number of lines to move.

If ⟨Pn⟩ is 0, 1, or omitted, the cursor moves up one line.

If ⟨Pn⟩ is greater than 1, the cursor moves up ⟨Pn⟩ lines.

POSSIBLE ERRORS

No scrolling occurs when an attempt is made to move the cursor above the top line of the scrolling region or above the top of the screen.

EXAMPLES

⟨ESC⟩ [A

Moves the cursor up one line.

⟨ESC⟩ [0 2 1 A

Moves the cursor up 21 lines. If the cursor was originally less than 21 lines down from the top of the screen (or scrolling region), the cursor is moved to the top line of the screen (or scrolling region).

Move Cursor Down Command [CUD] (Remote)

The Move Cursor Down command is a relative cursor movement command. It moves the cursor down the screen without affecting its column position.

Once the cursor enters a scrolling region, the cursor cannot be moved outside the scrolling region with a relative cursor movement command. The cursor stops at the edge of the scrolling region and the region is not scrolled. However, if the cursor is already outside the scrolling region, the Move Cursor Down command can move the cursor until it reaches the bottom edge of the screen.

When the cursor reaches the bottom line of the screen, the cursor cannot be moved any farther by this command. The cursor remains on the bottom line and the screen is not scrolled when an attempt is made to move the cursor past the bottom line.

When the cursor is moved between normal lines and double-width or double-size lines, the cursor moves across the screen horizontally as well as vertically. This is because the cursor follows character column positions, which are in different physical locations on the screen for normal and double-width (or double-size) lines. (Double-width and double-size lines are 40 columns wide, and normal lines are 80 columns wide.) For example, as the cursor moves between column 40 on a double-size line and column 40 on a normal line, the cursor's physical position jumps from the right margin of the screen on the double-size line to the center of the screen on the normal line.

DEFAULT

One line down.

OPERATOR USAGE

None. (This is a remote command only.)

HOST USAGE

⟨ESC⟩ [⟨Pn⟩ B

⟨Pn⟩ is a numeric parameter, designating the number of lines to move.

If ⟨Pn⟩ is 0, 1, or omitted, the cursor moves down one line.

If ⟨Pn⟩ is greater than 1, the cursor moves down ⟨Pn⟩ lines.

POSSIBLE ERRORS

No scrolling occurs when an attempt is made to move the cursor below the bottom line of the scrolling region or below the bottom of the screen.

EXAMPLES

⟨ESC⟩ [B

Moves the cursor down one line.

⟨ESC⟩ [0 2 1 B

Moves the cursor down 21 lines. If the cursor was originally less than 21 lines up from the bottom of the screen (or scrolling region), the cursor moves to the bottom line of the screen (or scrolling region).

Next Line Command [NEL] (Remote)

The Next Line command is a relative cursor movement command. It moves the cursor to column 1 (the first position) on the next line.

The Next Line command has the following effects:

- If the cursor is on the bottom line of the scrolling region when the command is received, the region is scrolled up.
- If the scrolling region is the entire screen and the cursor is on the bottom line when the command is received, the screen is scrolled up.
- If the cursor is outside the scrolling region when the command is received, the cursor is moved until it reaches the edge of the screen. Subsequent attempts to move the cursor beyond the bottom edge of the screen do not move the cursor, and do not scroll the screen.

DEFAULT

Not applicable.

OPERATOR USAGE

None. (This is a remote command only.)

HOST USAGE

〈ESC〉 E

Index Command [IND] (Remote)

The Index command is a relative cursor movement command. It moves the cursor down one line without affecting its column position.

The Index command differs from the Move Cursor Down command in that if the cursor is on the bottom line of the scrolling region when the Index command is sent, the region is scrolled up. (If the scrolling region is the entire screen, the screen is scrolled up.)

If the cursor is outside the scrolling region when this command is sent, the cursor is moved until it reaches the edge of the screen. Subsequent attempts to move the cursor beyond the bottom edge of the screen are ignored and do not scroll the screen.

When the cursor is moved between normal lines and double-width or double-size lines, the cursor moves across the screen horizontally as well as vertically. This is because the cursor follows character column positions, which are in different physical locations on the screen for normal and double-width (or double-size) lines. (Double-width and double-size lines are 40 columns wide, and normal lines are 80 columns wide.) For example, as the cursor moves between column 40 on a double-size line and column 40 on a normal line, the cursor's physical position jumps from the right margin of the screen on the double-size line to the center of the screen on the normal line.

DEFAULT

Not applicable.

OPERATOR USAGE

None. (This is a remote command only.)

HOST USAGE

〈ESC〉 D

Moves the cursor down one line in the same column. If the cursor is already on the bottom line of the scrolling region, this command causes the region to scroll up.

Reverse Index Command [RI] (Remote)

The Reverse Index command is a relative cursor movement command. It moves the cursor up one line without affecting the cursor's column position.

The Reverse Index command differs from the Move Cursor Up command in that if the cursor is on the top line of the scrolling region when the Reverse Index command is sent, the region is scrolled down. (If the scrolling region is the entire screen, the screen is scrolled down.)

If the cursor is outside the scrolling region when this command is issued, the cursor is moved until it reaches the edge of the screen. Subsequent attempts to move the cursor beyond the edge of the screen are prevented and do not scroll the screen.

When the cursor is moved between normal lines and double-width or double-size lines, the cursor moves across the screen horizontally as well as vertically. This is because the cursor follows character column positions, which are in different physical locations on the screen for normal and double-width (or double-size) lines. (Double-width and double-size lines are 40 columns wide, and normal lines are 80 columns wide.) For example, as the cursor moves between column 40 on a double-size line and column 40 on a normal line, the cursor's physical position ju[illegible] from the right margin of the screen on the double-size line to the center of the s[illegible]n on the normal line.

DEFAULT

Not applicable.

OPERATOR USAGE

None. (This is a remote command only.)

HOST USAGE

〈ESC〉 M

Moves the cursor up one line in the same column. If the cursor is already on the top line of the scrolling region when the command is issued, the region is scrolled down and the cursor is not moved from its position on the screen.

Read Cursor Position Command [CPR] (Remote)

The Read Cursor Position command allows the host to determine the cursor's position on the screen. This command is one option of the Request TCS Status command described in Section 8.

After receiving the Read Cursor Position command from the host, the TCS reports the vertical and horizontal position of the cursor by responding with a string in the following format:

⟨ESC⟩ [⟨Pl⟩ ; ⟨Pc⟩ R

⟨Pl⟩ is a numeric parameter, designating a line number.

⟨Pl⟩ is a number between 1 and 24 (inclusive). It represents the relative line number of the cursor. If the Origin Mode is set, line 1 is at the top of the scrolling region. If Origin Mode is reset, line 1 is at the top of the screen.

⟨Pc⟩ is a numeric parameter, designating a column number.

⟨Pc⟩ is a number between 1 and 80 (inclusive) for normal lines or a number between 1 and 40 (inclusive) for double-width or double-size lines. It represents the character column occupied by the cursor and properly takes into account double-width columns which occur within double-size or double-width lines.

The format of this response string can be changed by the Reporting Format command, which is discussed in detail in Section 4.

DEFAULT

Not applicable.

OPERATOR USAGE

None. (This is a remote command only.)

HOST USAGE

⟨ESC⟩ [6 n

EXAMPLE

⟨ESC⟩ [6 n

This command requests the TCS to report the cursor position. If the cursor is located halfway down and halfway across the screen on a normal line (not double-width or double-size), the TCS responds with:

⟨ESC⟩ [1 2 ; 4 0 R

Read Character Under Cursor Command {FRCUC} (Remote)

The Read Character Under Cursor command causes the TCS to identify (for the host) the character under the cursor, in effect, allowing the host to read any character displayed on the screen. This command is an option of the Request TCS Status command, which is described in Section 8.

The uses of this command include:

- Reading the entire screen and sending it to a printer.
- Saving a message that is displayed on the screen, displaying a new message in the same area, and then restoring the previous message.
- Testing the character memory of the TCS remotely.

After receiving the Read Character Under Cursor command from the host, the TCS responds by sending a control string to the host that identifies the character at the current position of the cursor. The control string takes the form:

〈ESC〉 [〉 3 ; 〈Pc〉 n

〈Pc〉 is the decimal value of the character under the cursor. For example, if 〈Pc〉 is 43, a plus ("+") is under the cursor.

The format of this response string can be changed by the Reporting Format command, which is discussed in detail in Section 4.

A character may have been displayed in one of two ways:

- The host can send a character directly to the TCS (either as a seven-bit eight-bit character or as a seven-bit ASCII character shifted to the extended character set with the Select Character Set command).
- The host can designate a National Replacement Code (NRC) and then send ASCII characters to the TCS. The TCS uses the NRC to "translate" the ASCII characters into the appropriate international character on the display.

If the character under the cursor was placed there using a National Replacement Code, the character is reported in the form:

〈ESC〉 [〉 3 ; 〈Pnrc〉 n

〈Pnrc〉 is the decimal value of the ASCII character that was originally sent by the host before the character was translated for display as an international character.

(It is the responsibility of the host to ensure that the NRC in effect when this command is sent matches the NRC used when the character was originally sent to the TCS.)

DEFAULT

Not applicable.

OPERATOR USAGE

None. (This is a remote command only.)

HOST USAGE

⟨ESC⟩ [> 3 n

POSSIBLE ERRORS

The TCS assumes that the NRC in effect when the Read Character Under Cursor command is sent is the same as when the character was sent to the TCS.

If this is not the case, when the Read Character Under Cursor command is received by the TCS, the TCS will return a control string to the host identifying a character that may not match the character originally sent by the host.

For example, assume the German NRC is selected and the host sends an ASCII "{" character that translates into an a umlaut (ä) for display on the screen. Now assume that the NRC is changed to Italian. If the Read Character Under Cursor command is sent, the TCS will attempt to find an a umlaut (ä) in the Italian NRC set and reverse map it to the original ASCII character. It will not be able to do so and will, therefore, return a string identifying the a umlaut (ä) as if it had been placed there without the use of an NRC.

EXAMPLES

⟨ESC⟩ [> 3 n

Requests the TCS to report the character under the cursor.

If the character is "g" (103 decimal, 67 hex), the TCS responds:

⟨ESC⟩ [> 3 ; 1 0 3 n

If the character is "e grave" (è) and the current NRC is "Italian", the TCS responds:

⟨ESC⟩ [> 3 ; 1 2 5 n

NOTE

"e grave" (è) maps into "}", which is 7D in hex and 125 in decimal.

If the cursor is over the upper-left corner of Boxtype 2 (136 decimal, 88 hex), the TCS responds:

⟨ESC⟩ [> 3 ; 1 3 6 n

Read Attributes Under Cursor Command {FRAUC} (Remote)

The Read Attributes Under Cursor command allows the host to read the character attributes shown on the screen. This command is an option of the Request TCS Status command described in Section 8.

The Read Attributes Under Cursor command is used to:

- Read the entire screen and send it to a printer.
- Save a message displayed on the screen, display a new message in the same area, and then restore the previous message.
- Test the attribute memory of the TCS remotely.

After receiving this command, the TCS responds by sending the host the attributes of the character at the current position of the cursor as follows:

〈ESC〉 [〉4 ; 〈Phi〉 ; 〈Pul〉 ; 〈Pblink〉 ; 〈Prv〉 n

The format of this response string can be changed by the Reporting Form command, which is discussed in detail in Section 4.

〈Phi〉 is the Highlight attribute.

If 〈Phi〉 is 1, Highlight is on.

If 〈Phi〉 is 2 2, Highlight is off.

〈Pul〉 is the Underline attribute.

If 〈Pul is 4, Underline is on.

If 〈Pul〉 is 2 4, Underline is off.

〈Pblink〉 is the Blink attribute.

If 〈Pblink〉 is 5, Blink is on.

If 〈Pblink〉 is 2 5, Blink is off.

〈Prv〉 is the Reverse-Video attribute.

If 〈Prv〉 is 7, Reverse-Video is on.

If 〈Prv〉 is 2 7, Reverse-Video is off.

DEFAULT

Not applicable.

OPERATOR USAGE

None. (This is a remote command only.)

HOST USAGE

〈ESC〉 [〉 4 n

Requests the TCS to report the attributes of the character at the the current cursor location.

EXAMPLE

The host requests the TCS to report the attributes under the cursor by sending:

〈ESC〉 [〉 4 n

If the character under the cursor is blinking, the TCS responds with:

〈ESC〉 [〉 4 ; 2 2 ; 2 4 ; 5 ; 2 7 ; n

Cursor Type Command {FCT} (Local/Remote)

The Cursor Type command selects one of the following types of cursors:

- Non-Blinking Reverse-Video Block

  The cursor appears as a reverse-video, full character cell block and does not blink.

- Slow-Blinking Reverse-Video Block

  The cursor appears as a full character cell block and blinks every 1.07 seconds (when the Refresh Rate is 60 Hz) or every 1.28 seconds (when the Refresh Rate is 50 Hz) with a 50% duty cycle.

  NOTE

  50% duty cycle means that the cursor is "on" half of the time.

- Fast-Blinking Reverse-Video Block

  The cursor appears as a full-character cell block and blinks every 0.53 seconds (at 60 Hz) or every 0.64 seconds (at 50 Hz) with a 50% duty cycle.

- Non-Blinking Underline

  The cursor appears as an underline and does not blink.

- Slow-Blinking Underline

  The cursor appears as an underline and blinks every 1.07 seconds (at 60 Hz) or every 1.28 seconds (at 50 Hz) with a 50% duty cycle.

- Fast-Blinking Underline

  The cursor appears as an underline and blinks every 0.53 seconds (at 60 Hz) or every 0.64 seconds (at 50 Hz) with a 50% duty cycle.

- Invisible

  The cursor is not visible.

OPERATOR USAGE

The user selects the cursor type by entering the Setup Screen and, using touchkeys or the optional keyboard, setting the Cursor Type parameter to the desired cursor type.

When the Cursor Type is changed by the user through the Setup Screen, the cursor itself is displayed as the parameter's value in the Parameter List Area of the Setup Screen. The displayed cursor type changes immediately when the cursor type is changed.

DEFAULT

Power-up default value is slow-blinking reverse-video block. Default action with missing parameters causes the previous cursor to become visible.

HOST USAGE

⟨ESC⟩ [⟨Ps⟩ ; ... ; ⟨Ps⟩ v

⟨Ps⟩ is a selective parameter, designating a cursor type.

If ⟨Ps⟩ is 0 or omitted, the previous cursor type is made visible.

If ⟨Ps⟩ is 1, the current cursor type is made invisible.

If ⟨Ps⟩ is 2, the cursor is an underline.

If ⟨Ps⟩ is 3, the cursor is a reverse-video block.

If ⟨Ps⟩ is 4, the cursor is non-blinking.

If ⟨Ps⟩ is 5, the cursor is slow-blinking.

If ⟨Ps⟩ is 6, the cursor is fast-blinking.

NOTE

Parameter values may be combined to select multiple cursor attributes with a single control string (see examples, below). Invalid selective parameters are ignored.

POSSIBLE ERRORS

If the host asks for two or more incompatible cursor characteristics in the same control string (such as underline followed by reverse-video block), the last cursor characteristic (reverse-video block) takes precedence.

EXAMPLES

⟨ESC⟩ [3 v

Selects the reverse-video block cursor. The cursor blinks at the same rate as the previous cursor. The cursor is invisible if the previous cursor was invisible.

⟨ESC⟩ [2 ; 4 ; 0 v

Selects the underline cursor and makes it non-blinking and visible.

⟨ESC⟩ [4 ; 6 v

Makes the cursor fast-blinking. The fast-blinking characteristic takes precedence over the non-blinking characteristic because it is the last cursor characteristic in the control string. (This example has no practical use, but illustrates how conflicting requests are resolved by the TCS.)

SCREEN APPEARANCE COMMANDS

The Screen Appearance commands affect the appearance of the entire screen. The Screen Appearance commands are:

- Screen Background Mode command (Local/Remote)
- Display Activity command (Local/Remote)
- Horizontal Alignment command (Local/Remote)
- Vertical Alignment command (Local/Remote)
- Vertical Refresh Rate command (Local)

These commands are described in detail in the following pages. For ease of reference, each command description begins at the top of a new page.

NOTE

Where applicable, command names are followed by the appropriate mnemonic. Mnemonics in square brackets [ ] are ANSI-specified commands. Mnemonics in braces { } are ANSI-compatible, Fluke-private commands. Mnemonics in parentheses ( ) are ANSI-compatible, DEC-private commands.

For clarity, this manual shows spaces between the characters in each control string. These spaces must be omitted when programming the TCS.

Screen Background Mode Command (DECSCNM) (Local/Remote)

The Screen Background Mode command sets or resets the Screen Background Mode, which determines whether the background of the screen is dark or light.

- When the Screen Background mode is reset ("normal"), the background of each character (without reverse-video attributes) is unlit and the foreground is lit. This creates a dark background with lit characters.
- When the Screen Background mode is set ("reverse"), the background of each character (without reverse-video attributes) is lit and the foreground is unlit. This creates a lit background with dark characters.

Changes in the Screen Background Mode take affect immediately, whether the command is issued locally from the Setup Screen (by the user) or remotely (by a control string from the host).

DEFAULT

Reset. (Normal video.)

OPERATOR USAGE

The user selects the screen background by entering the Setup Screen and, using touchkeys or the optional keyboard, setting the Background parameter to one of the following values:

- "normal" (reset)
- "reverse" (set)

HOST USAGE

〈ESC〉[?5l

Resets the background to "normal".

〈ESC〉[?5h

Sets background to "reverse".

Display Activity Command {FDA} (Local/Remote)

The Display Activity command turns the display on or off, or programs an automatic timeout (i.e., the screen is automatically turned off) following periods of inactivity.

The automatic timeout is a feature that turns off the display during periods of inactivity longer than 30 minutes, thereby extending the life of the phosphor on the CRT.

- When the display activity is set to "on", the display stays lit (even during extended periods of inactivity).
- When the display activity is set to "off", the screen is turned off. Even though the display appears blank, data continues to be processed normally by the TCS just as if the display were turned on. The display remains off, even if there is user or host activity, until the display activity is changed to "on" or "timeout", or the Setup Screen is entered.

NOTE

Regardless of the display activity setting, the screen always turns on when the Setup Screen is entered.

- When the display activity is set to "timeout", the display turns off if 30 minutes elapse without user or host activity. After the display has timed out, any activity by the user or host causes the display to turn back on. For example, the screen turns back on if the user presses any key or touches the touch panel, or if the host sends a character or command.

After timeout has occurred, the first user activity sensed by the TCS (including activation of the Setup Screen) turns on the screen and starts a new timeout cycle, but the TCS does not interpret this activity as a command to be sent to the host. For example, if the user wants to transmit the space character to the host after the display has timed out, he must press any key or touch the display, then press the space bar. However, the first activity from the host after a timeout has occurred causes the screen to turn on and is interpreted as a command.

NOTE

If display activity is set to "off" and saved with a Save Setup, the next time power is applied to the TCS, the TCS starts up with the screen off.

DEFAULT

On.

OPERATOR USAGE

The user sets the display activity by entering the Setup Screen and, using touchkeys or the optional keyboard, setting the Display Activity parameter to one of the following values:

- "on"
- "off"

- "timeout"

The display activity setting does not take effect until the Setup Screen is exited.

HOST USAGE

⟨ESC⟩ [3 ; ⟨Ps⟩ z

⟨Ps⟩ is a selective parameter, designating the Display Activity.

If ⟨Ps⟩ is 0 or omitted, Display Activity is set "on".

If ⟨Ps⟩ is 1, Display Activity is set "off".

If ⟨Ps⟩ is 2, Display Activity is set to "timeout".

EXAMPLES

⟨ESC⟩ [3 z

Turns the display on immediately.

⟨ESC⟩ [3 ; 1 z

Turns the display off immediately.

⟨ESC⟩ [3 ; 2 z

Enables automatic timeout of the display after 30 minutes of inactivity.

Horizontal Alignment {FHA} (Local/Remote)

The Horizontal Alignment command controls the horizontal position of the display on the CRT.

The horizontal alignment may be shifted left or right from its present position. The total range of adjustment spans 12 characters. Each movement results in a shift of one character.

DEFAULT

The alignment shifts left one character.

OPERATOR USAGE

The user issues the Horizontal Alignment command by entering the Setup Screen, entering the Alignment Screen, and pressing either the horizontal arrow touchkeys on the Alignment Screen or the horizontal arrow keys on the optional keyboard.

For complete instructions on how to use the Alignment Screen, refer to the User's Guide.

HOST USAGE

⟨ESC⟩ [6 ; ⟨Ps⟩ z

⟨Ps⟩ is a selective parameter, designating a shift to the left or right.

If ⟨Ps⟩ is 0 or omitted, the horizontal alignment is shifted one character left.

If ⟨Ps⟩ is 1, the horizontal alignment is shifted one character right.

POSSIBLE ERRORS

If the horizontal alignment is already at its right-most position and a shift right command is received, the command is ignored.

If the horizontal alignment is already at its left-most position and a shift left command is received, the command is ignored.

EXAMPLES

⟨ESC⟩ [6 z

Shifts the horizontal alignment left one character.

⟨ESC⟩ [6 ; 1 z

Shifts the horizontal alignment right one character.

Vertical Alignment Command {FVA} (Local/Remote)

This command controls the vertical position of the display on the TCS. The vertical alignment may be shifted up or down from its current position. The range of adjustment spans 2.4 character lines (each character row is 10 scan lines high). Each movement results in a shift of 0.1 character line (1 scan line).

DEFAULT

The display alignment shifts 0.1 character line (one scan line) down.

OPERATOR USAGE

The user issues the Vertical Alignment command by entering the Setup Screen, entering the Alignment Screen, and pressing either the vertical arrow touchkeys on the Alignment Screen or the vertical arrow keys on the optional keyboard.

For complete instructions on how to use the Alignment Screen, refer to the User's Guide.

HOST USAGE

⟨ESC⟩ [5 ; ⟨Ps⟩ z

⟨Ps⟩ is a selective parameter, representing a shift up or down.

If ⟨Ps⟩ is 0 or omitted, vertical alignment shifts downward 0.1 character row (one scan line).

If ⟨Ps⟩ is 1, vertical alignment shifts upward 0.1 character row (one scan line).

NOTE

Invalid selective parameters are ignored.

POSSIBLE ERRORS

If the vertical alignment is already at its highest position and a shift upward command is received, it is ignored.

If the vertical alignment is already at its lowest position and a shift downward command is received, it is ignored.

EXAMPLES

⟨ESC⟩ [5 z

Shifts the vertical alignment downward 0.1 character row.

⟨ESC⟩ [5 ; 1 z

Shifts the vertical alignment upward 0.1 character row.

Vertical Refresh Rate Command (Local)

The Vertical Refresh Rate command allows the user to match the rate at which the screen is refreshed (redrawn) to the frequency of local line power. The user can choose a refresh rate of 50 or 60 Hz.

- When the Vertical Refresh Rate is set to "60Hz", the display is refreshed at a 60-Hz, non-interleaved rate. This rate minimizes the effects of 60-Hz stray magnetic fields on the display.
- When the Vertical Refresh Rate is set to "50Hz", the display is refreshed at a 50-Hz, non-interleaved rate. This rate minimizes the effects of 50-Hz stray magnetic fields on the display.

NOTE

Because a 60-Hz refresh rate repaints the screen more often than a 50-Hz rate, screen flicker is minimized. However, with a power line frequency of 50 Hz, a 60-Hz refresh rate may not provide enough display stability if the display is not well shielded from the effects of or removed from stray magnetic fields.

DEFAULT

60 Hz

OPERATOR USAGE

The user selects the vertical refresh rate by entering Setup Screen and, using touchkeys or the optional keyboard, setting the Refresh Rate parameter to one of the following values:

- "60Hz"
- "50Hz"

HOST USAGE

None. (This is a local command only.)

Section 6
Programming the Touch Panel

INTRODUCTION

This section describes how to create touchkeys on the Touch Control Screen (TCS). Topics include:

- The touch panel
- Touch reporting
- The commands used to create touchkeys and touch targets

For ease of reference, the commands are divided into two groups, consisting of functionally related commands:

- Region Commands
- Touch Panel Commands

NOTE

Sample touch panel programs are provided in Section 9.

THE TOUCH PANEL

The transparent touch panel is the key feature of the TCS that allows the user to communicate with the host simply by touching labeled, touch-sensitive blocks on the display.

The programmer creates each touch-sensitive block and defines its function in the host program. The user then simply touches the block to make a menu selection, control a process, direct the operation of a program, etc.

Touch Cells

The touch panel consists of a thin, transparent, flexible switch matrix that is affixed to the front of the TCS display. The switch matrix contains 120 individual switches called touch cells. The touch cells are are activated (closed) at the touch of a fingertip (or other soft object).

The 120 touch cells are arranged in a grid 10 columns wide by 12 rows high. Each touch cell covers an area 8 characters wide by 2 characters high and is identified by a

unique number which the TCS can report to the host when the touch cell is touched. Touch cell numbers allow the host to respond appropriately to touch cell reports from the TCS. The touch cell number assignments are shown in Figure 6-1.

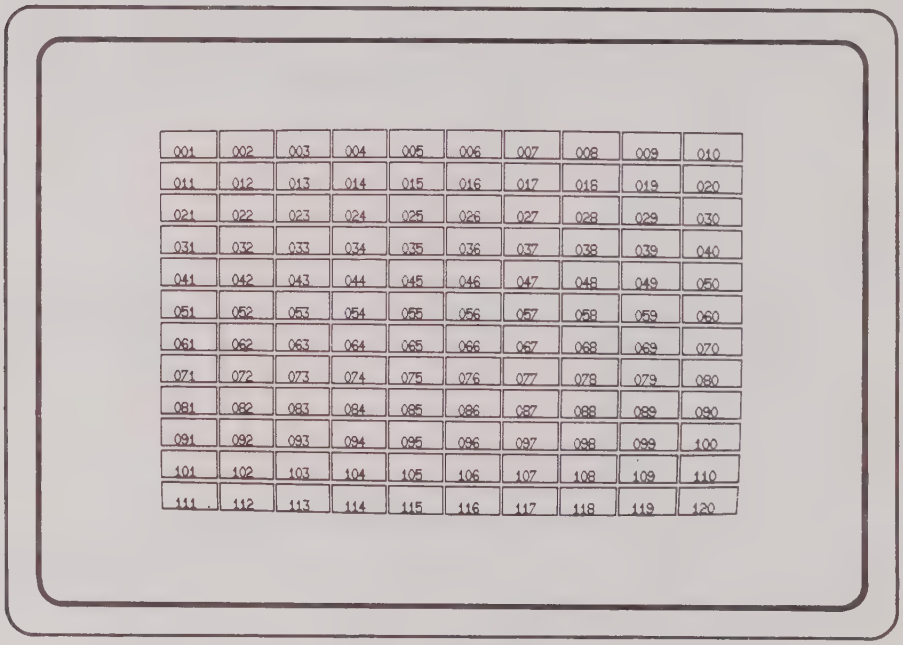


Figure 6-1. Touch Cell Number Assignments

Touchkeys and Touch Targets

The host program can incorporate touch cells into units called touchkeys. A touchkey consists of one or more touch cells and is usually associated with a visual target (called a "touch target") on the screen. A touchkey consisting of multiple touch cells enlarges the surface which the user can touch for a specific function, thereby eliminating the difficulty of attempting to touch a single touch cell and, at the same time, reducing the chance of the user activating a wrong touch cell due to parallax error.

The host must be programmed to respond identically to all touch cells belonging to the same touchkey. In this way, touching any one of the touch cells in the touchkey produces the same effect. A touchkey normally includes as many touch cells as necessary to cover a touch target.

To identify a touchkey for the user, the host program should display a touch target that matches the touchkey. The touch target visually guides the user to the correct region of the touch panel. Touch targets are usually outlined and labeled, and are easy to create using Region commands (described later in this section).

Figure 6-2 illustrates a touch target for a touchkey composed of four touch cells.

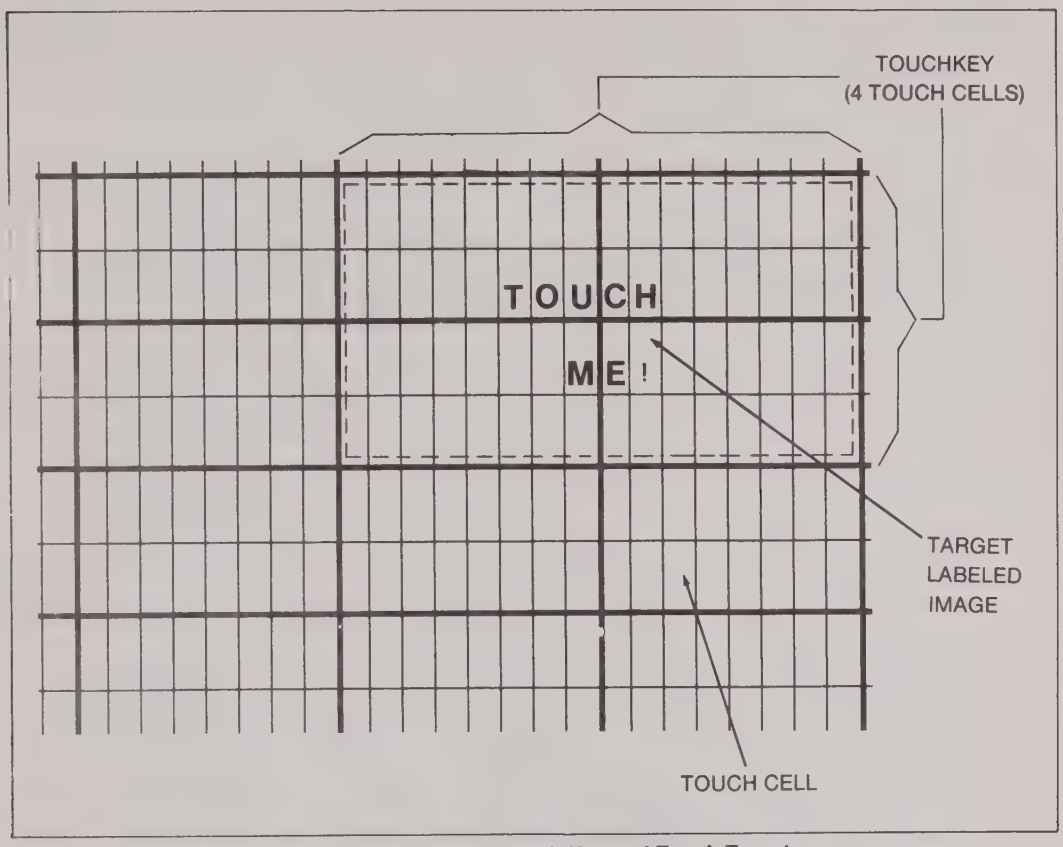


Figure 6-2. Example Touch Key and Touch Target

TOUCH REPORTING

The touch panel is divided into 12 rows and 10 columns of individual touch cells. (See Figure 6-1.) Each touch cell has a unique numeric value, which the TCS reports to the host. The TCS can send touch reports either spontaneously (whenever a touch cell is touched) or only when the TCS is polled for a response (using the Polled Touch Mode).

Normally, the TCS spontaneously sends a touch report to the host whenever a touch cell is touched. However, when the host is busy or has particularly slow input/output service, it may be advantageous to operate the touch panel in the Polled Touch Mode. In the Polled Touch Mode, the TCS sends the host a touch report only when the host requests (polls) the TCS to do so. This lessens the burden on the host and minimizes the possibility of data overruns and lost characters. The Polled Touch Mode is fully documented later in this section.

In either case, the TCS sends each touch report in the following format:

〈ESC〉 [〉 2 ; 〈Pn〉 n

〈Pn〉 is a three-digit, zero-filled ASCII numeric string (000 through 120, inclusive) which represents the number of the touch cell.

For example, if the user activates touch cell number 81, the following report is sent to the host:

⟨ESC⟩ [⟩ 2 ; 0 8 1 n

NOTE

The TCS supports several touch reporting controls and formats. The host may select the touch report introducers and/or terminator by using the Reporting Format command, which is described in Section 4.

REGION COMMANDS

Region commands outline or erase a defined area on the screen, and modify the attributes of characters and lines within a defined area.

Region commands, thereby, provide a simple way for the programmer to create visual touch targets on the display.

The Region commands are:

- Erase a Region command (Remote)
- Outline a Region command (Remote)
- Modify Character Attributes in a Region command (Remote)

These commands are described in detail in the following pages. For ease of reference, each command description begins at the top of a new page.

NOTE

Where applicable, command names are followed by the appropriate mnemonic. Mnemonics in square brackets [ ] are ANSI-specified commands. Mnemonics in braces { }are ANSI-compatible, Fluke-private commands. Mnemonics in parentheses ( ) are ANSI-compatible, DEC-private commands.

For clarity, this manual shows spaces between the characters in each control string. These spaces must be omitted when programming the TCS.

Erase a Region Command {FER} (Remote)

The Erase a Region command is sent by the host to erase a designated area of the display.

Each character that is erased is replaced by a blank (a Space character). The attribute of each character position in the erased region reverts to "off", unless the NOCHANGE Attribute Mode is set.

The region to be erased is defined relative to the cursor position, which becomes the upper-left corner of the region. The number of lines (height) and number of columns (width) making up the region are specified by numeric parameters.

The region of the display affected by this command is restricted to the scrolling region if the Origin Mode is set.

Within a defined region, the host can restrict the effect of this command to one of the following areas:

- Inner characters

  Only those characters within a region that are not adjacent to an edge (border) of the region are erased.

- Border characters

  Only those characters within a region that are adjacent to an edge (border) of the region are erased.

- All characters

  All the characters (inner and border) in the region are erased.

In order for the Erase a Region command to produce proper and predictable results, the line type of the region must be determined. Line type is determined according to the following rules:

- If the region contains any double-size lines, the entire region is assumed to be made up of alternating, double-size, top and bottom lines.
- If the region contains any double-width lines, the entire region is assumed to be made up of double-width lines.
- If the region does not contain any double-width or double-size lines, the region is assumed to be composed of all normal lines.

NOTE

Undesirable results may be produced if the Erase a Region command is executed on a region containing mixed line types.

DEFAULT

Erases all (inner and border) characters in an area below and to the right of the cursor.

OPERATOR USAGE

None. (This is a remote command only.)

HOST USAGE

⟨ESC⟩ [8 ; ⟨Pl⟩ ; ⟨Pc⟩ ; ⟨Pv⟩ t

⟨Pl⟩ is a numeric parameter between 0 and 24 (inclusive), which designates the height of the region in lines.

If ⟨Pl⟩ is 0 or omitted, a region with a height of 24 lines is defined.

⟨Pc⟩ is a numeric parameter between 0 and 80 (inclusive), which designates the width of the region in columns.

If ⟨Pc⟩ is 0 or omitted, a region 80 columns wide is defined.

⟨Pv⟩ is a selective parameter, which indicates the amount of the region to be erased.

If ⟨Pv⟩ is 0 or omitted, all characters in the region are erased.

If ⟨Pv⟩ is 1, only the inner characters are erased.

If ⟨Pv⟩ is 2, only the border characters are erased.

If ⟨Pv⟩ is 3, all the characters in the region are erased.

POSSIBLE ERRORS

Undesirable results may be produced if the Erase a Region command is executed over a region containing mixed line types.

If the region specified runs off the edge or bottom of the screen, the edge of the region is assumed to be along the screen edges. When Origin Mode is set, the edges of the scrolling region are treated as if they were the edges of the screen.

EXAMPLES

⟨ESC⟩ [8 t

Erases the entire screen if Origin Mode is reset and the cursor is in the home position.

⟨ESC⟩ [8 ; 2 ; 4 5 ; 3 t

A 2-line by 45-column region is erased (relative to the location of the cursor, which represents the upper-left corner of the region).

Outline a Region Command {FOR} (Remote)

The Outline a Region command places a border around an area of the screen defined relative to the cursor, thereby drawing a touch target. The position of the cursor is not changed when this command is executed.

The region of the display affected by this command is restricted to the scrolling region if the Origin Mode is set.

The attribute(s) of the border are determined by the attribute(s) already defined by the last Set Character Attributes command (unless the NOCHANGE Attribute Mode is set). For example, if the Set Character Attributes command has turned on the "blink" attribute, the border is blinks.

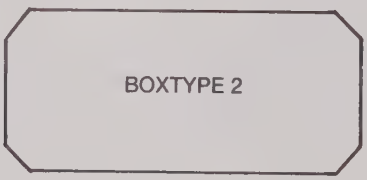
The border of a region consists of those character positions within the region that are adjacent to the region's edges. The upper-left corner of the border is located at the current position of the cursor.

Four border types are available. Each border is drawn using a different Boxtype character. A border using each Boxtype character is shown below:

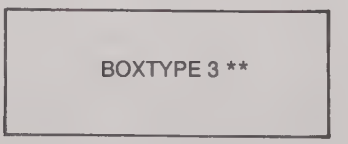
- Border using Boxtype 1

*Border on *outer* edge of Character cell.

- Border using Boxtype 2

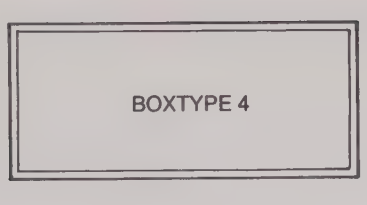


- Border using Boxtype 3



**Border on *inner* edge of Character cell.

- Border using Boxtype 4



In order for the Outline a Region command to produce proper and predictable results, the region's line type must be determined. Line type is determined according to the following rules:

- If the region contains any double-size lines, the entire region is assumed to be made up of alternating, double-size, top and bottom lines.
- If the region contains any double-width lines, the entire region is assumed to be made up of double-width lines.
- If the region does not contain any double-width of double-size lines, the region is assumed to be composed of all normal lines.

NOTE

Undesirable results may be produced if the Outline a Region command is executed on a region containing mixed line types.

DEFAULT

A border using Boxtype 1 is drawn around the area below and to the right of the cursor.

OPERATOR USAGE

None. (This is a remote command only.)

HOST USAGE

⟨ESC⟩ [6 ; ⟨Pl⟩ ; ⟨Pc⟩ ; ⟨Pb⟩ t

⟨Pl⟩ is a numeric parameter between 0 and 24 (inclusive), which designates the height of the region in lines.

If ⟨Pl⟩ is 0 or omitted, a region with a height of 24 lines is defined.

⟨Pc⟩ is a numeric parameter between 0 and 80 (inclusive), which designates the width of the region in columns.

If ⟨Pc⟩ is 0 or omitted, a region 80 columns wide is defined.

⟨Pb⟩ is a selective parameter, which designates the type of border to place around the defined region.

If ⟨Pb⟩ is 0 or omitted, Boxtype 1 is used.

If ⟨Pb⟩ is 1, Boxtype 1 is used.

If ⟨Pb⟩ is 2, Boxtype 2 is used.

If ⟨Pb⟩ is 3, Boxtype 3 is used.

If ⟨Pb⟩ is 4, Boxtype 4 is used.

POSSIBLE ERRORS

Undesirable results may be produced if the Outline a Region command is executed over a region containing mixed line types.

If the region specified runs off the edge or bottom of the screen, the edge of the region is assumed to be along the screen edges. When Origin Mode is set, the edges of the scrolling region are treated as if they were the edges of the screen.

EXAMPLES

⟨ESC⟩ [6 t

If Origin Mode is reset and the cursor is at the home position (row 1, column 1), a border using Boxtype 1 border is drawn around the entire screen.

⟨ESC⟩ [6 ; 1 0 ; 5 ; 3 t

A border using Boxtype 3 is drawn around a rectangular region 10-lines high by 5-columns wide. The location of the cursor marks the upper-left corner of the rectangle.

⟨ESC⟩ [6 ; 6 ; 1 0 t

Places a border using Boxtype 1 around a rectangular region 6-lines high by 10-columns wide. The location of the cursor marks the upper-left corner of the area.

Modify Character Attributes in a Region Command {FMCAIR} (Remote)

The Modify Character Attributes in a Region command causes the character attributes within a defined region to be modified on a regional basis, rather than character-by-character.

This command assigns to the designated region the attributes currently in effect (as last assigned by the Set Character Attributes command). Because the Modify Character Attributes in a Region command directly causes attributes to be modified, the NOCHANGE Attribute Mode has no affect on this command.

The region to be acted upon by this command is defined relative to the cursor position, which becomes the upper-left corner of the region. The number of lines (height) and number of columns (width) making up the region are specified by numeric parameters.

The region of the display affected by this command is restricted to the scrolling region if the Origin Mode is set.

Within a defined region, the host can restrict the effect of this command to one of the following areas:

- Inner characters

  Only those characters within a region that are not adjacent to an edge (border) of the region are affected.

- Border characters

  Only those characters within a region that are adjacent to an edge (border) of the region are affected.

- All characters

  All the characters (inner and border) in the region are affected.

In order for the Modify Character Attributes command to produce proper and predictable results, the region's line type must be determined. Line type is determined according to the following rules:

- If the region contains any double-size lines, the entire region is assumed to be made up of alternating, double-size, top and bottom lines.

- If the region contains any double-width lines, the entire region is assumed to be made up of double-width lines.

- If the region does not contain any double-width of double-size lines, the region is assumed to be composed of all normal lines.

NOTE

Undesirable results may be produced if the Modify Character Attributes in a Region command is executed on a region containing mixed line types.

DEFAULT

Modifies the attributes of all characters in an area below and to the right of the cursor.

OPERATOR USAGE

None. (This is a remote command only.)

HOST USAGE

⟨ESC⟩ [7 ; ⟨Pl⟩ ; ⟨Pc⟩ ; ⟨Pv⟩ t

⟨Pl⟩ is a numeric parameter between 0 and 24 (inclusive), which designates the height of the region in lines.

If ⟨Pl⟩ is 0 or omitted, a region with a height of 24 lines is defined.

⟨Pc⟩ is a numeric parameter between 0 and 80 (inclusive), which designates the width of the region in columns.

If ⟨Pc⟩ is 0 or omitted, a region 80 columns wide is defined.

⟨Pv⟩ is a selective parameter, designating which portion of the region is affected by the command.

If ⟨Pv⟩ is 0 or omitted, the attributes of all characters in the region are modified.

If ⟨Pv⟩ is 1, only the attributes of inner characters are modified.

If ⟨Pv⟩ is 2, only the attributes of border characters are modified.

If ⟨Pv⟩ is 3, the attributes of all characters in the region are modified.

POSSIBLE ERRORS

Undesirable results may be produced if the Modify Character Attributes in a Region command is executed on a region containing mixed line types.

If the region specified runs off the edge or bottom of the screen, the edge of the region is assumed to be along the screen edges. When Origin Mode is set, the edges of the scrolling region are treated as if they were the edges of the screen.

EXAMPLES

⟨ESC⟩ [7 t

Modifies the entire screen if Origin Mode is reset and the cursor is in the home position (row 1, column 1).

⟨ESC⟩ [7 ; 1 2 ; 5 1 ; 2 t

Modifies the border attributes of a region 12 lines high by 51 columns wide relative to the cursor (which marks the upper-left corner of the border).

TOUCH PANEL COMMANDS

The Touch Panel commands control the operation of the touch panel. The Touch Panel commands are:

- Polled Touch Mode command (Remote)
- Read Touch Cell Status command (Remote)
- Auto-Repeat Rate command (Remote)
- Touch Cell Audible Attribute command (Remote)
- Touch Panel Lockout Mode command (Remote)

These commands are described in detail in the following pages. For ease of reference, each command description begins at the top of a new page.

NOTE

Where applicable, command names are followed by the appropriate mnemonic. Mnemonics in square brackets [ ] are ANSI-specified commands. Mnemonics in braces { } are ANSI-compatible, Fluke-private commands. Mnemonics in parentheses ( ) are ANSI-compatible, DEC-private commands.

For clarity, this manual shows spaces between the characters in each control string. These spaces must be omitted when programming the TCS.

Polled Touch Mode Command {FPTM} (Remote)

The Polled Touch Mode command selects the Polled Touch Mode, which causes the TCS to report touch cell closures only when requested (polled) by the host.

The Polled Touch Mode prevents data overruns and lost characters when the TCS is used with a host that has a slow I/O response. The Polled Touch Mode is also useful when it is undesirable for the host to use interrupt processing.

The Polled Touch Mode is used in conjunction with the Read Touch Cell Status command, which the hosts sends to request a touch cell report. That command is described in later in this section.

- When the Polled Touch Mode is reset, the TCS spontaneously sends a touch cell report to the host whenever the user activates a touch cell.

- When the Polled Touch Mode is set, the TCS queues one and only one touch cell report when the user activates a touch cell. The TCS sends the report to the host only when the host sends the Read Touch Cell Status command. If multiple touch cells are touched before the host polls the TCS for a report, the TCS queues a touch cell report only for the first touch; the TCS ignores all other touches, which are in effect locked out.

NOTE

If the TCS receives a Read Touch Cell Status command and the user has not touched a touch cell since the previous Read Touch Cell Status command was received, the TCS reports a touch cell number of "000".

If the Touch Cell Audible Attribute is set, the TCS beeps immediately when a touch cell is touched. However, if the TCS has already queued a touch report and is waiting to send the report to the host, additional touches are ignored and do not cause beeping.

An auto-repeat rate can be set when the TCS is operating in the Polled Touch Mode. However, the rate of auto-repeating may be limited by the frequency of the host's requests for reports. (See the discussion under the heading, "Auto-Repeat Rate Command", later in Section 6.) If the host requests touch reports rapidly enough, the TCS responds at the same auto-repeat rate regardless of whether the Polled Touch Mode is set or reset.

DEFAULT

Reset. (Touch Polled Mode is off.)

OPERATOR USAGE

None. (This is a remote command only.)

HOST USAGE

〈ESC〉 [〉 1 l Resets Polled Touch Mode (to off).

〈ESC〉 [〉 1 h Sets Polled Touch Mode (to on).

Read Touch Cell Status Command {FRTS} (Remote)

The Read Touch Cell Status command requests the TCS to send a touch report for the last touch cell touched but not yet reported on. This command is used when the TCS is operating in the Polled Touch Mode (i.e., when the Polled Touch Mode is set to "on"). The Read Touch Cell Status command is one option of the Request TCS Status command, which is described in Section 8.

When the TCS receives the Read Touch Cell Status command, the TCS sends a report to the host in the following format:

〈ESC〉[〉2 ; 〈Pk〉 n

〈Pk〉 is the last touch cell touched but not yet reported. (For details, see the heading, Touch Reporting, earlier in this section.)

If the TCS in not holding a touch report for the host, the TCS returns the touch cell number "000".

If the TCS is not operating in the Polled Touch Mode, the TCS reports the touch cell number "000", indicating that no touch reports are waiting to be sent.

NOTE

When the Polled Touch Mode is set ("on"), the TCS queues one and only one touch cell report when the user activates a touch cell. If multiple touch cells are touched before the host polls the TCS for a report, the TCS queues a touch cell report only for the first touch; the TCS ignores all other touches, which are in effect locked out.

DEFAULT

Not applicable.

OPERATOR USAGE

None. (This is a remote command only.)

HOST USAGE

〈ESC〉[〉2 n

EXAMPLE

〈ESC〉[〉2 n

Requests the TCS to send the next touch report to the host.

If the TCS is operating in the Polled Touch Mode, and if the user has touched cell number 105, the TCS would send the following report:

〈ESC〉[〉2 ; 1 0 5 n

Auto-Repeat Rate Command {FARR} (Remote)

The Auto-Repeat Rate command allows the host to set the auto-repeat rate for touch cell reporting.

The auto-repeat rate is the rate at which touch reports are sent (or made available) to the host when a touch cell is pressed continuously. The auto-repeat rate can be any value between 0 (off) and 25.5 seconds (inclusive).

The effect of this command is determined by the setting of the Polled Touch Mode:

- If the Polled Touch Mode is reset and a touch cell is pressed continuously, the auto-repeat rate is the rate at which the TCS spontaneously sends touch reports to the host.
- If the Polled Touch Mode is set and a touch cell is pressed continuously, the auto-repeat rate is limited by the rate at which the host requests (polls) the TCS to send touch reports.

When a touch cell is first pressed, there is a 1/2-second delay before the auto-repeat rate takes effect. The auto-repeat rate then stays in effect as long as the touch cell is pressed (or until a Clear User Inputs command or Touch Lock-out command is sent by the host).

NOTE

If the user continues to press the touchkey after the Clear User Inputs command is received, a touch report will be generated for the touchkey as if it had been pressed for the first time. See the description of the Clear User Inputs command, in Section 4.

DEFAULT

0 (off)

OPERATOR USAGE

None. (This is a remote command only.)

HOST USAGE

⟨ESC⟩ [2 ; ⟨Pn⟩ u

⟨Pn⟩ is a numeric parameter (from 0 through 255, inclusive), which specifies the delay (in tenths of seconds) between automatic repetitions.

If ⟨Pn⟩ is 0 or omitted, auto-repeating is disabled.

If ⟨Pn⟩ is 1 through 255, the auto-repeat rate is set to ⟨Pn⟩ multiplied by 0.1 seconds (i.e., to 0.1 through 25.5 seconds).

EXAMPLES

〈ESC〉[2 ; 3 u

The auto-repeat rate is set to 0.3 seconds.

〈ESC〉[2 ; 1 0 0 u

The auto-repeat rate is set to 10 seconds.

〈ESC〉[2 u

Auto-repeating is disabled.

Touch Cell Audible Attribute Command {FTAA} (Remote)

The Touch Cell Audible Attribute command specifies whether the TCS beeps when a touch cell is activated by the user.

The touch panel may be assigned one of two audible attributes:

- Silent

  None of the touch cells beep when touched.

- Beep

  The TCS beeps automatically when any touch cell is touched.

NOTE

If auto-repeating is enabled and the touch cell is held beyond an initial delay, the TCS beeps at the auto-repeat rate until the touch cell is released (or until a Clear User Inputs command or Touch Lock-out command is sent by the host).

NOTE

If the TCS is in the Polled Touch Mode and the Touch Cell Audible Attribute is set to beep, the TCS beeps immediately when a touch cell is touched. However, the TCS does not beep if the TCS has already queued a touch cell report which the host has not yet read.

DEFAULT

Beep.

OPERATOR USAGE

None. (This is a remote command only.)

HOST USAGE

⟨ESC⟩ [1 ; ⟨Ps⟩ u

⟨Ps⟩ is a selective parameter, which specifies the audible attribute to be assigned to the touch panel.

If ⟨Ps⟩ is 0 or omitted, the audible attribute of all touch cells is silent.

If ⟨Ps⟩ is 1, the audible attribute of all touch cells is beep.

EXAMPLES

〈ESC〉[1 u

The audible attribute of all touch cells is set to silent.

〈ESC〉[1 ; 0 u

The audible attribute of all touch cells is set to silent.

〈ESC〉[1 ; 1 u

The audible attribute of all touch cells is set to beep.

Touch Panel Lockout Mode Command {FTLM} (Remote)

The Touch Panel Lockout Mode command controls the Touch Panel Lockout Mode, which allows the host to lock out user input from the touch panel. This command does not affect the optional keyboard.

- When the Touch Panel Lockout Mode is reset, input is allowed from the touch panel. (The touch panel is unlocked).
- When the Touch Panel Lockout Mode is set, input is not allowed from the touch panel. (The touch panel is locked).

In the event the TCS receives a Read Touch Cell Status command when the Touch Panel Lockout Mode is set, the TCS reports the touch cell number "000" to indicate no inputs have occurred. (The format of this report is described under the heading, Read Touch Cell Status Command, earlier in this section.)

If the user enters the Setup Screen (either by pressing the SET UP switch or the Set Up key) when the Touch Panel Lockout Mode is set, the touch panel is temporarily unlocked. When the user exits the Setup Screen, the touch panel reverts to the locked state.

If the user is pressing a touchkey while the Touch Lock-out Mode is in the process of being set, and the touchkey has begun auto-repeating, the touchkey will stop auto-repeating.

DEFAULT

Reset (unlocked).

OPERATOR USAGE

None. (This is a remote command only.)

HOST USAGE

〈ESC〉[〉2 l

Resets Touch Panel Lockout Mode (unlocks the touch panel).

〈ESC〉[〉2 h

Sets Touch Panel Lockout Mode (locks the touch panel).

Section 7
Programming the Keyboard

INTRODUCTION

This section describes how to program the optional keyboard. Topics include:

- A description of the keyboard
- A list of the codes that the keyboard transmits to the host
- A description of the commands that affect the keyboard's operation.

KEYBOARD DESCRIPTION

The optional keyboard has keys similar to those on an ordinary typewriter, with the addition of some special keys. The keyboard contains standard keys, a Setup key, cursor control keys, special function keys, and an auxiliary keypad. The keyboard layout is shown in Figure 7-1.

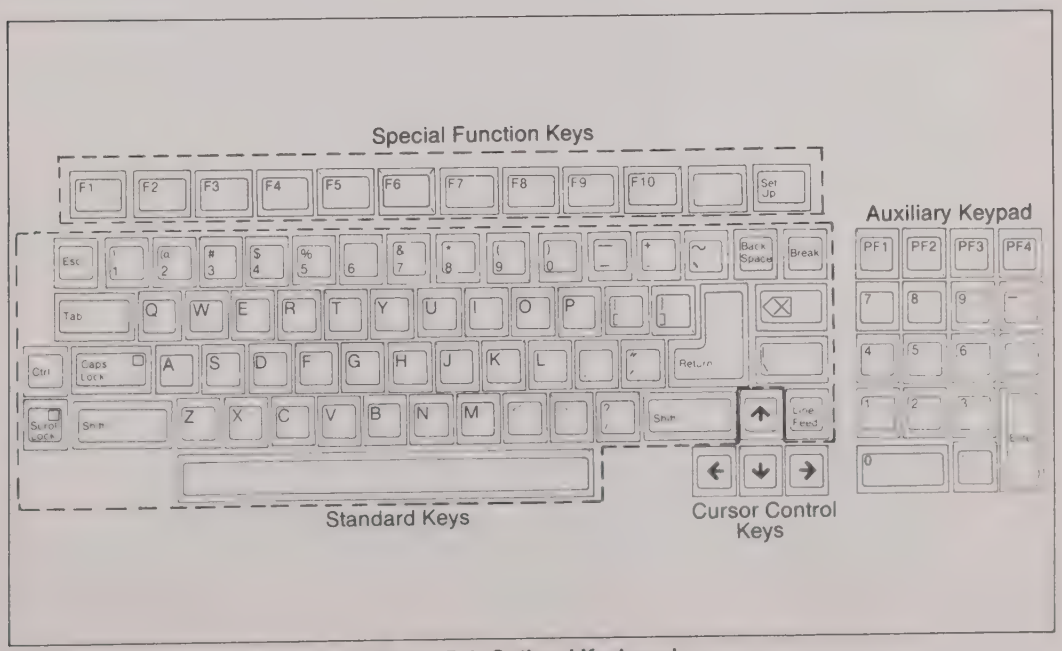


Figure 7-1. Optional Keyboard

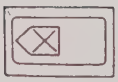
Standard Keys

The standard keys generate ASCII characters. The standard keys have the names of ASCII characters printed on the keycaps and generate only ASCII codes.

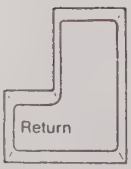
Some of the non-alphanumeric keys are described below. Note that the function of most of these keys is ultimately determined by the application software running on the host computer. The ASCII codes sent to the host computer by the non-alphanumeric standard keys are shown in Table 7-1.

The Back Space key normally causes the cursor to move one space to the left. However, the function of the Back Space key is determined by the application software running on the host computer.

The Break key generates a short break when pressed alone, or a long break when pressed in conjunction with the Shift key. The Break key normally resets the communication interfaces with a device attached to the TCS. However, the function of the Break key is determined by the types of peripherals connected to the TCS and the application software running on the host computer. (For more information, see the headings, Send Short Break Command and Send Long Break Command, later in this section.)



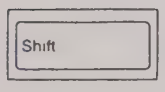
This is the Delete key. The Delete key normally moves the cursor one space to the left, deleting the character that occupied the space. However, the function of the Delete key is determined by the application software running on the host computer.



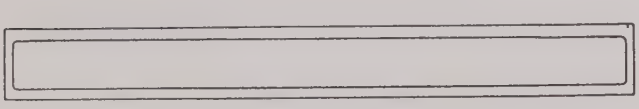
The Return key sends either the ASCII character ⟨CR⟩ or the ASCII character sequence ⟨CR⟩ ⟨LF⟩ to the host, depending on the state of the New Line Mode. See the heading, New Line Mode Command, in Section 5.

The Return key normally moves the cursor to the first column of the next line. However, the action caused by sending ⟨CR⟩ or ⟨CR⟩ ⟨LF⟩ to the host computer is determined by the application software running on the host computer.

The Line Feed key normally moves the cursor one line down. However, the function of the Line Feed key is determined by the application software running on the host computer.



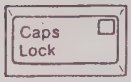
The Shift key alone does not generate a code. It is used with other standard keys to send upper-case characters, by holding down Shift while pressing another key. The upper-case characters include capital letters and upper-case symbols.



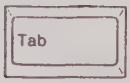
The Space Bar normally moves the cursor one space to the right, leaving an invisible space character in its place. However, the function of the Space Bar is determined by the application software running on the host computer.

The Scroll Lock key stops the TCS from interpreting commands in its input buffer, which freezes the display. Scroll Lock freezes the display whether or not the host supports flow control. There is no interaction between Ctrl/S, Ctrl/Q, and Scroll Lock. If the host does not support flow control, a buffer overflow error may be displayed when scrolling is resumed. The LED indicator on the Scroll Lock key is lit when scrolling is locked, and off when scrolling is unlocked.

The Ctrl key alone does not send a code. It is used with other standard keys to send control codes by holding down the Ctrl key while pressing another key. For example, the Ctrl key can be used to send a control code that causes the TCS to beep. The keystrokes Ctrl/G (when echoed to the TCS) normally cause the beeper to sound. Table 7-2 shows the characters that are transmitted by the TCS when various keys are pressed with the Ctrl key. The action caused by sending these control codes to the host computer is determined by the application software running on the host computer.



The Caps Lock key locks when pressed, and unlocks when pressed again. When the Caps Lock key is locked, all alphabetic keys generate capital letters. When the Caps Lock key is unlocked, all alphabetic keys generate lower-case letters (unless an alphabetic key is pressed along with the Shift key). Numeric or symbolic keys are unaffected by the Caps Lock key. The LED indicator on the Caps Lock key is lit when the key is locked, and off when the key is unlocked.



The Tab key normally moves the cursor one tab space to the right. However, the function of the Tab key is determined by the application software running on the host computer.

The Esc (escape) key generates the ASCII character ⟨ESC⟩. The function of the Esc key is determined by the application software running on the host computer.

Table 7-1. Non-Alphanumeric Standard Key Codes

KEY	CODE(S) SENT TO HOST (HEXADECIMAL)	ASCII MNEMONIC
⌫	7F	⟨DEL⟩
Tab	09	⟨HT⟩
Return	0D or 0D0A *	⟨CR⟩ or ⟨CR⟩ ⟨LF⟩*
Line Feed	0A	⟨LF⟩
Space Bar	20	⟨SPACE⟩
Esc	1B	⟨ESC⟩
Back Space	08	⟨BS⟩

* Depends on the state of the New Line parameter.

The Set Up Key

The Set Up key does not transmit anything to the host computer. It is used to call up the Setup Screen, and to exit the Setup, Test, and Alignment Screens. It serves exactly the same function as the rear panel SET UP switch. See the heading, Using the Setup Screen, for more information.

Cursor Control Keys

The cursor control keys transmit ANSI cursor control sequences to the host as shown in Table 7-3. These are special sequences of ASCII characters defined by the American National Standards Institute (ANSI). Cursor control sequences are also called escape sequences.

Table 7-2. Codes Sent by Keys When Pressed with the Ctrl Key

KEY (PRESSED WITH CTRL KEY)	CODE SENT TO HOST (HEXADECIMAL)	ASCII MNEMONIC
2 or Space Bar	00	⟨NULL⟩
A	01	⟨SOH⟩
B	02	⟨STX⟩
C	03	⟨ETX⟩
D	04	⟨EOT⟩
E	05	⟨ENQ⟩
F	06	⟨ACK⟩
G	07	⟨BEL⟩
H	08	⟨BS⟩
I	09	⟨HT⟩
J	0A	⟨LF⟩
K	0B	⟨VT⟩
L	0C	⟨FF⟩
M	0D or 0D0A*	⟨CR⟩
N	0E	⟨SO⟩
O	0F	⟨SI⟩
P	10	⟨DLE⟩
Q	11	⟨DC1⟩ (XON)
R	12	⟨DC2⟩
S	13	⟨DC3⟩ (XOFF)
T	14	⟨DC4⟩
U	15	⟨NAK⟩
V	16	⟨SYN⟩
W	17	⟨ETB⟩
X or ⌫	18	⟨CAN⟩
Y	19	⟨EM⟩
Z	1A	⟨SUB⟩
3 or [	1B	⟨ESC⟩
4 or \	1C	⟨FS⟩
5 or]	1D	⟨GS⟩
6 or ~ or ‘	1E	⟨RS⟩
7 or ? or /	1F	⟨US⟩
8	7F	⟨DEL⟩

*Depends on the state of the New Line Parameter

Table 7-3. Cursor Control Key Codes

KEY	CODE SEQUENCE SENT TO HOST	ACTION TAKEN IF ECHOED TO THE TCS
↑	⟨ESC⟩ [A	Moves the cursor one line up
↓	⟨ESC⟩ [B	Moves the cursor one line down
→	⟨ESC⟩ [C	Moves the cursor one space to the right
←	⟨ESC⟩ [D	Moves the cursor one space to the left

The cursor control keys normally move the cursor on the screen. However, the function of the cursor control keys is determined by the application software running on the host computer.

Special Function Keys

The special function keys transmit escape sequences to the host as shown in Table 7-4. (An escape sequence is a series of ASCII characters beginning with the 〈ESC〉 character.) The special function keys may also be pressed with the Shift key or the Ctrl key to generate additional escape sequences. These escape sequences are also shown in Table 7-4. How the host computer responds to these escape sequences depends on the application software. The unlabled special function key does not send any codes to the host.

Table 7-4. Special Function Key Codes

KEY(S)	CODE SEQUENCE SENT TO HOST
F1	〈ESC〉[01~
F2	〈ESC〉[02~
F3	〈ESC〉[03~
F4	〈ESC〉[04~
F5	〈ESC〉[05~
F6	〈ESC〉[06~
F7	〈ESC〉[07~
F8	〈ESC〉[08~
F9	〈ESC〉[09~
F10	〈ESC〉[10~
Shift/F1	〈ESC〉[11~
Shift/F2	〈ESC〉[12~
Shift/F3	〈ESC〉[13~
Shift/F4	〈ESC〉[14~
Shift/F5	〈ESC〉[15~
Shift/F6	〈ESC〉[16~
Shift/F7	〈ESC〉[17~
Shift/F8	〈ESC〉[18~
Shift/F9	〈ESC〉[19~
Shift/F10	〈ESC〉[20~
Ctrl/F1	〈ESC〉[21~
Ctrl/F2	〈ESC〉[22~
Ctrl/F3	〈ESC〉[23~
Ctrl/F4	〈ESC〉[24~
Ctrl/F5	〈ESC〉[25~
Ctrl/F6	〈ESC〉[26~
Ctrl/F7	〈ESC〉[27~
Ctrl/F8	〈ESC〉[28~
Ctrl/F9	〈ESC〉[29~
Ctrl/F10	〈ESC〉[30~

Auxiliary Keypad

The auxiliary keypad is the group of keys on the right side of the keyboard. (See Figure 7-1.) The auxiliary keypad can be programmed to operate in one of two modes using the Keypad Mode command. In the Numeric Mode, the auxiliary keypad transmits numeric codes to the host. In the Application Mode, the auxiliary keypad transmits application code sequences to the host. Both sets of codes are shown in Table 7-5. The default mode for the auxiliary keypad is the Numeric Mode.

The Keypad Mode command is described later in this section.

Table 7-5. Auxiliary Keypad Codes

KEY	NUMERIC CODES SENT TO HOST	APPLICATION CODES SENT TO HOST
0	0	⟨ESC⟩ O p
1	1	⟨ESC⟩ O q
2	2	⟨ESC⟩ O r
3	3	⟨ESC⟩ O s
4	4	⟨ESC⟩ O t
5	5	⟨ESC⟩ O u
6	6	⟨ESC⟩ O v
7	7	⟨ESC⟩ O w
8	8	⟨ESC⟩ O x
9	9	⟨ESC⟩ O y
-	-	⟨ESC⟩ O m
,	,	⟨ESC⟩ O l
.	.	⟨ESC⟩ O n
Enter	⟨CR⟩ or ⟨CR⟩ ⟨LF⟩*	⟨ESC⟩ O M
PF1	⟨ESC⟩ O P	⟨ESC⟩ O P
PF2	⟨ESC⟩ O Q	⟨ESC⟩ O Q
PF3	⟨ESC⟩ O R	⟨ESC⟩ O R
PF4	⟨ESC⟩ O S	⟨ESC⟩ O S

*Depends on the state of the New Line parameter (set in the Setup Screen).

KEYBOARD COMMANDS

The Keyboard commands affect the operation of the optional keyboard. The Keyboard commands are:

- Keyboard Lockout Mode command (Remote)
- Keypad Mode command (Remote)
- Local/Remote command (Local)
- Send Long Break command (Local)
- Send Short Break command (Local)

These commands are described in detail in the following pages. For ease of reference, each command description begins at the top of a new page.

NOTE

Where applicable, command names are followed by the appropriate mnemonic. Mnemonics in square brackets [ ] are ANSI-specified commands. Mnemonics in braces { } are ANSI-compatible, Fluke-private commands. Mnemonics in parentheses ( ) are ANSI-compatible, DEC-private commands.

For clarity, this manual shows spaces between the characters in each control string. These spaces must be omitted when programming the TCS.

Keyboard Lockout Mode Command [KAM] (Remote)

The Keyboard Lockout Mode command sets and resets the Keyboard Lockout Mode. This allows the host to block input from the keyboard.

When the Keyboard Lockout Mode is set, keyboard entries are ignored by the TCS (the keyboard is locked). Setting the Keyboard Lockout Mode also precludes access to the Setup Screen through the Set Up key on the keyboard. When the Keyboard Lockout Mode is reset, input is allowed from the keyboard (the keyboard is unlocked).

When the keyboard is locked, the user can call up the Setup Screen only if the user has access to the rear panel SET UP switch. Once the Setup Screen is activated, the keyboard is temporarily unlocked so that the user can use it to change parameters in the Setup Screen. Once the Setup Screen is exited, the keyboard is again locked to all user input.

DEFAULT

Reset. (The keyboard is unlocked.)

OPERATOR USAGE

None. (This is a remote command only.)

HOST USAGE

〈ESC〉[2 l

Resets the Keyboard Lockout Mode, which unlocks the keyboard.

〈ESC〉[2 h

Sets the Keyboard Lockout Mode, which locks the keyboard.

POSSIBLE ERRORS

If the host sets the Keyboard Lockout Mode while the user is keying in a sequence, the sequence is interrupted. To avoid this, it is recommended that the host follow the Keyboard Lockout Mode command by a Clear User Inputs command to ensure that no partial user input strings are left waiting to be reported to the host.

Keypad Mode Command (DECPAM) (DECPNM) (Remote)

The Keypad Mode command sets the auxilliary keypad to either the Numeric Mode or the Application Mode. This allows the host to select whether the auxiliary keypad on the optional keyboard sends numeric codes or application codes to the host.

When the keypad is set to the Numeric Mode, the keypad sends numeric codes to the host.

When the keypad is set to the Application Mode, the keypad sends special control sequences to the host. This allows the keypad to be used for specialized applications where each key is specially interpreted by the host software.

The numeric codes and application codes sent by the keypad are described under the heading, Auxiliary Keypad, earlier in this section.

DEFAULT

Numeric Mode. (The keypad sends numeric codes.)

OPERATOR USAGE

None. (This is a remote command only.)

HOST USAGE

〈ESC〉 =

Sets the auxiliary keypad to the Application Mode. (The keypad sends application codes.)

〈ESC〉 〉

Sets the auxiliary keypad to the Numeric mode. (The keypad sends numeric codes.)

Local/Remote Mode Command (Local)

The Local/Remote Mode command controls whether the TCS accepts remote commands from the host computer or from the keyboard. The command sets the TCS either to the Remote Mode (in which the TCS accepts remote commands from the host) or to the Local Mode (in which the TCS accepts remote commands from the keyboard).

For complete details about how to use the Local/Remote Mode command, refer to its description in Section 4.

Send Long Break Command (Local)

The Send Long Break command causes the TCS to hold the RS-232-C Data Terminal Ready (DTR) and Request to Send (RTS) lines off (low) for approximately 3.5 seconds.

This command is typically used to initiate disconnection from the host equipment, particularly with a modem that is communicating to a remote computer over a telephone line.

DEFAULT

Not applicable.

OPERATOR USAGE

The user issues the Send Long Break command by typing Shift/Break on the optional keyboard (holding down the Shift key while pressing the Break key).

HOST USAGE

None. (This is a local command only.)

POSSIBLE ERRORS

Any input received from the host during transmission of the long break signal is ignored.

Send Short Break Command (Local)

The Send Short Break command causes the RS-232-C Transmitted Data (TD) line to be held in the "0" or SPACE state for approximately 300 milliseconds. This can be used as a special signal to the host that can be recognized at any baud rate.

A typical use of the Short Break command is to signal to the host to cycle through a choice of baud rates until the baud rate matching that of the TCS is established.

OPERATOR USAGE

The user issues the Send Short Break command by pressing the Break key on the optional keyboard.

HOST USAGE

None. (This is a local command only.)

POSSIBLE ERRORS

Any input received from the host during transmission of the short break signal is ignored.

Section 8
Remote Self-Testing

INTRODUCTION

This section explains two kinds of commands:

- Status Reporting commands
- Remote Self-Test commands

The Status Reporting commands report the status of the Touch Control Screen (TCS). The Remote Self-Test commands activate and report the results of self-tests built into the TCS. Together, these commands permit the host to perform confidence tests and ensure that various parts of the TCS are operating properly.

The user can access these and other self-tests locally by means of the Test Screen. The tests that can be accessed locally are described in the User's Guide.

NOTE

All status reports supported by the TCS are summarized in Section 3.

STATUS REPORTING COMMANDS

Status Reporting commands allow the host to ascertain the present operational status of the TCS. The Status Reporting commands are:

- Power-Up Interrupt Mode command (Remote)
- Request Power Status command (Remote)
- Request TCS Identification command (Remote)
- Request TCS Status command (Remote)

These commands are described in detail in the following pages. For ease of reference, each command description begins at the top of a new page.

NOTE

Where applicable, command names are followed by the appropriate mnemonic. Mnemonics in square brackets [ ] are ANSI-specified commands. Mnemonics in braces { } are ANSI-compatible, Fluke-private commands. Mnemonics in parentheses ( ) are ANSI-compatible, DEC-private commands.

For clarity, this manual shows spaces between the characters in each control string. These spaces must be omitted when programming the TCS.

Power-Up Interrupt Mode Command {FPUIM} (Remote)

The Power-Up Interrupt Mode command is used to set or reset the Power-Up Interrupt mode.

When the Power-Up Interrupt Mode is set, the TCS generates an interrupt to the host after regaining power. This interrupt can be used by the host to detect whether the integrity of the TCS has been disturbed by a loss of power during operation. The host can then act appropriately to ensure that proper communication resumes with the user. This might entail resending command sequences to the TCS or resending the previous display contents.

The default power-up interrupt sent by the TCS to the host is the command string:

〈ESC〉[ ] 1 n

When the Power-Up Interrupt Mode is reset, the TCS does not generate an interrupt to the host after the TCS regains power.

The state of the Power-Up Interrupt Mode is preserved in non-volatile memo during power loss. This allows the TCS to remember whether a power-up interru is to be generated at the next power-up.

The Power-Up Interrupt Mode may also be set or reset by the host using the Se Mode command and Reset Mode command, respectively. (See Section 3.)

The power-up interrupt control string is affected by the Reporting Format command. The control string will be generated using the Reporting Format in use when power was lost. For a detailed description of the Reporting Format command, See Section 3.

DEFAULT

Not applicable.

OPERATOR USAGE

None. (This is a remote command only.)

HOST USAGE

〈ESC〉[ ] 4 l

Resets the Power-Up Interrupt mode.

〈ESC〉[ ] 4 h

Sets the Power-Up Interrupt mode.

Request Power Status Command {FRPS} (Remote)

The Request Power Status command allows the host to determine if the TCS has lost power since the last Request Power Status command.

DEFAULT

Not applicable.

OPERATOR USAGE

None. (This is a remote command only.)

HOST USAGE

〈ESC〉[ ] 0 n

If the TCS has not lost power since the last Request Power Status command, the TCS responds to the Request Power Status command by sending the following string to the host:

〈ESC〉[ ] 0 n

If the TCS has lost power since the last Request Power Status command, the TCS responds with:

〈ESC〉[ ] 1 n

Request TCS Identification Command [DA] (Remote)

The Request TCS Identification command allows the host to determine the following facts about the TCS:

- The type of TCS with which it is communicating.
- The firmware version installed in the TCS.
- The programmable options that are installed in the TCS.

DEFAULT

Not applicable.

OPERATOR USAGE

None. (This is a remote command only.)

HOST USAGE

This command has two equivalent forms:

⟨ESC⟩ [c

⟨ESC⟩ [0 c

Either string requests TCS identification. The TCS responds with the following string:

⟨ESC⟩ [⟨Pt⟩ ; ⟨Pv⟩ ; ⟨Ps⟩ c

⟨Pt⟩ is the TCS type (⟨Pt⟩ = 1: 1020 Series).

⟨Pv⟩ is the firmware version (⟨Pv⟩ = mn: firmware version is m.n).

⟨Ps⟩ is always 0 in this version.

EXAMPLE

An example of a TCS identification sequence sent to the host in response to this command is:

⟨ESC⟩ [1 ; 1 2 ; 0 c

This string indicates the TCS type is Model 1020 (1), and the firmware version is 1.2 (1 2). ⟨Ps⟩ is always 0 in this version.

Request TCS Status Command [DSR] (Remote)

The Request TCS Status command allows the host to determine the operational status of the TCS.

The TCS responds by indicating whether or not it has had a malfunction since the TCS was last powered-up or reset. (A malfunction is any error detected by the TCS either during self-test or normal operation.) If a malfunction has occurred, the TCS attempts to continue operating.

DEFAULT

Not applicable.

OPERATOR USAGE

None. (This is a remote command only.)

HOST USAGE

〈ESC〉 [5 n

If no malfunction has occurred in the TCS since the TCS was last powered-up or reset, the TCS responds to this command by sending the following string to the host:

〈ESC〉 [0 n

If a malfunction has occurred in the TCS since the TCS was last powered-up or reset, the TCS responds by sending the following string:

〈ESC〉 [3 n

EXAMPLE

〈ESC〉 [5 n

This control string from the host requests the operational status of the TCS. If no malfunction has occurred since the TCS was last powered-up or reset, the TCS responds by sending the string:

〈ESC〉 [0 n

REMOTE SELF-TEST COMMANDS

The Remote Self-Test commands activate and report on self-tests built into the TCS.

These tests verify that selected parts of the TCS are in proper operating condition. The Remote Self-Test commands are:

- Continuous Integrity Test command (Local/Remote)
- Request ROM Test Report command (Remote)
- Request Non-Volatile Memory Test Report command (Remote)
- Request RAM Test Report command (Remote)
- Request Touch Panel Test Report command (Remote)

These commands are described in detail in the following pages. For ease of reference, each command description begins at the top of a new page.

NOTE

Where applicable, command names are followed by the appropriate mnemonic. Mnemonics in square brackets [ ] are ANSI-specified commands. Mnemonics in braces { }are ANSI-compatible, Fluke-private commands. Mnemonics in parentheses ( ) are ANSI-compatible, DEC-private commands.

For clarity, this manual shows spaces between the characters in each control string. These spaces must be omitted when programming the TCS.

Continuous Integrity Test Command {FCIT} (Local/Remote)

The Continuous Integrity Test command places the TCS into the Continuous Integrity Test. This test is a continuous testing loop that verifies proper operation of the TCS electronics.

The Continuous Integrity Test command activates the following tests sequentially in a continuously repeating cycle:

- ROM Checksum Test
- Non-Volatile Memory Checksum Test
- RAM Test
- Touch Panel Closure Test or Touch Panel Loopback Test

NOTE

The ROM Checksum Test, the Non-Volatile Memory Checksum Test, and the RAM Test are the same as those described in the User's Guide, under the heading, Power-Up Sequence.

When the Continuous Integrity Test is entered locally, the touch panel test performed is always the Touch Panel Closure Test.

When the Continuous Integrity Test is entered remotely, either the Touch Panel Closure Test or the Touch Panel Loopback Test can be specified. The Touch Panel Loopback Test should only be specified when a Touch Panel Loopback Connector (a special test fixture) is installed in place of the touch panel.

Once the Continuous Integrity Test is activated, it can be terminated locally by pressing the SET UP switch on the rear panel or the Set Up key on the optional keyboard, or terminated remotely by performing a Reset command.

When the test is begun, any errors detected since the TCS was last powered-up or reset are cleared and test execution begins.

RESULTS

The test displays the following information on the screen:

- Elapsed time since test started
- Overall pass/fail indicator
- Number of test passes completed
- Number of ROM checksum errors
- Number of non-volatile memory checksum errors
- Number of RAM failures

- Number of Touch Panel Test failures
- Last faulty ROM checksum
- Last faulty Non-volatile memory checksum
- Last faulty RAM address and data sent, data received
- RAM data pattern failure history
- Last Touch Panel Closure Test touch cell failure or last Touch Panel Loopback Test failure patterns sent and received

All checksums, addresses, data sent, data received and failure history values are displayed in hexadecimal. All other numbers are displayed in decimal.

The RAM data pattern failure history contains a 1 in each bit position where a data error has been detected throughout the history of the Continuous Integrity Test.

To obtain results remotely, the host must send the TCS the control string for one of the Request Test Report commands described later in this section.

When the test is entered locally (through the Setup Screen), input from the host is still received, but is not processed (similar to operation in the Setup Screen). If the host continues to send data to the TCS, eventually the input buffer becomes full and an XOFF character is automatically sent to the host. For this reason, when the test is entered locally, it is not possible for the host to get test results remotely while the test is in progress.

When the test is entered remotely, input from the host is still received and is processed normally. The only inputs from the host that are useful during the Continuous Integrity Test are the Request Test Report commands and the Reset command. Any other input from the host could corrupt the test results that are displayed on the screen.

OPERATOR USAGE

The user issues the Continuous Integrity Test command by entering the Test Screen and then touching the CONTINUOUS INTEGRITY touchkey or pressing Shift/8 on the optional keyboard.

HOST USAGE

⟨ESC⟩ [2 ; 9 ; ⟨Ps⟩ y

⟨Ps⟩ is a selective parameter specifying the type of touch panel test to be performed.

If ⟨Ps⟩ is omitted or 0, the Touch Panel Closure Test is selected.

If ⟨Ps⟩ is 1, the Touch Panel Loopback Test is selected.

POSSIBLE ERRORS

If the touch panel is touched while the Touch Panel Closure Test is running, a touch panel failure is logged.

Although host input is still processed after the Continuous Integrity Test command is sent remotely, it is recommended that only the Request Test Report commands or Reset command be used. Any other commands could corrupt the Continuous Integrity Test display.

EXAMPLES

〈ESC〉[2;9y

Activates the Continuous Integrity Test, assuming that the touch panel is installed. The touch panel test run is the Touch Panel Integrity Test.

〈ESC〉[2;9;1y

Activates the Continuous Integrity Test, assuming that the Touch Panel Loopback Connector is installed. The touch panel test run is the Touch Panel Loopback Test.

Request ROM Test Report Command {FRRTR} (Remote)

The Request ROM Test Report command allows the host to obtain detailed results of ROM testing during the Continuous Integrity Test or after automatic self-testing. The host receives a response from this command while the Continuous Integrity Test is in progress only if the Continuous Integrity Test was activated by the host rather than locally by the user.

The TCS responds to the Request ROM Test Report command by sending to the host the ROM Test results obtained since the Continuous Integrity Test started or since the TCS was last powered-up or reset.

DEFAULT

The test results are always reinitialized to zero at the start of the Continuous Integrity Test, when power is applied, or when the TCS is reset.

OPERATOR USAGE

None. (This is a remote command only.)

HOST USAGE

〈ESC〉 [〉 6 n

The TCS responds with:

〈ESC〉 [〉 6 ; 〈Ploops〉 ; 〈Pfail〉 ; 〈Psum〉 n

〈Ploops〉 is the number of ROM checksum tests completed since the Continuous Integrity Test started or since the TCS was last powered-up or reset.

〈Pfail〉 is the number of ROM checksum tests that detected a failure since the Continuous Integrity Test started or since the TCS was last powered-up or reset.

〈Psum〉 is the decimal equivalent of the the last failed checksum. The value of 〈Psum〉 is 0 if no checksum errors have been detected.

EXAMPLES

〈ESC〉 [〉 6 n

This control string from the host requests a ROM Test report. If only the power-up tests have been performed and no ROM checksum errors were detected, the TCS responds with:

〈ESC〉 [〉 6 ; 1 ; 0 ; 0 n

If the Continuous Integrity Test has completed 12 loops and detected ROM checksum errors during 5 of those test loops, and the most recent checksum in error had a decimal value of 165, the TCS responds with:

〈ESC〉 [〉 6 ; 1 2 ; 5 ; 1 6 5 n

Request Non-Volatile Memory Test Report Command {FRETR} (Remote)

The Request Non-Volatile Memory Test Report command allows the host to obtain detailed results of non-volatile memory testing during the Continuous Integrity Test or after automatic self-testing.

The host receives a response from this command while the Continuous Integrity Test is in progress only if the Continuous Integrity Test was activated by the host rather than locally by the user.

The TCS responds to the Request Non-Volatile Memory Test Report command by sending to the host the Non-Volatile Memory Test results obtained since the Continuous Integrity Test started or since the TCS was last powered-up or reset.

DEFAULT

The test results are always reinitialized to zero at the start of the Continuous Integrity Test, when power is applied, or when the TCS is reset.

OPERATOR USAGE

None. (This is a remote command only.)

HOST USAGE

〈ESC〉[> 7 n

The TCS responds with:

〈ESC〉[> 7 ; 〈Ploops〉 ; 〈Pfail〉 ; 〈Psum〉 n

〈Ploops〉 indicates the number of non-volatile memory checksum tests completed since the Continuous Integrity Test was started or since the TCS was last powered-up or reset.

〈Pfail〉 indicates the number of non-volatile memory checksum tests that detected a failure since the Continuous Integrity Test started or since the TCS was last powered-up or reset.

〈Psum〉 is the decimal equivalent of the last failed checksum. The value of 〈Psum〉 is 0 if no checksum errors have been detected.

EXAMPLES

〈ESC〉[> 7 n

This control string from the host requests a Non-Volatile Memory Test report. If only the power-up tests have been performed and no non-volatile memory checksum error was detected, the TCS responds with:

〈ESC〉[> 7 ; 1 ; 0 ; 0 n

If the Continuous Integrity Test has completed 112 loops and detected non-volatile memory checksum errors during 23 of those test loops, and the most recent checksum in error had a decimal value 46, the TCS instead responds with:

〈ESC〉[> 7 ; 1 1 2 ; 2 3 ; 4 6 n

Request RAM Test Report Command {FRRATR} (Remote)

The Request RAM Test Report command allows the host to obtain detailed results of RAM testing during the Continuous Integrity Test or automatic self-testing. The host receives a response from this command while the Continuous Integrity Test is in progress only if the Continuous Integrity Test was activated by the host rather than locally by the user.

The TCS responds to the Request RAM Test Report command by sending to the host the RAM Test results obtained since the Continuous Integrity Test started or since the TCS was last powered-up or reset.

DEFAULT

The test results are always reinitialized to zero at the start of the Continuous Integrity Test, when power is applied, or when the TCS is reset.

OPERATOR USAGE

None. (This is a remote command only.)

HOST USAGE

〈ESC〉[> 8 n

The TCS responds with:

〈ESC〉[> 8 ; 〈Ploops〉 ; 〈Pfail〉 ; 〈Paddr〉 ; 〈Perror〉 ; 〈Phistory〉 n

〈Ploops〉 indicates the number of RAM tests completed since the Continuous Integrity Test started or since the TCS was last powered-up or reset.

〈Pfail〉 indicates the number of RAM tests that detected at least one failure since the Continuous Integrity Test started or since the TCS was last powered-up or reset.

〈Paddr〉 is the decimal equivalent of the last failed address. The value of 〈Paddr〉 is 0 if no errors have been detected.

〈Perror〉 is the decimal equivalent of the data value sent to the last failed address exclusive-ORed with the data value received at the last failed address.

〈Phistory〉 is the decimal equivalent of the data bit error history. The data bit error history is a 16-bit word that (a) contains a logic 0 in each bit position that has never shown an error during all RAM testing and (b) contains a logic 1 in any bit position that has contained an error during RAM testing.

EXAMPLES

〈ESC〉[> 8 n

This control string from the host requests a RAM Test report. If only a power-up test has been performed and no RAM errors were detected, the TCS responds with:

〈ESC〉[> 8 ; 1 ; 0 ; 0 ; 0 ; 0 n

⟨ESC⟩[>8n

This control string from the host requests a RAM Test report. Assume the Continuous Integrity Test has completed 3 loops and detected RAM errors during 2 of those loops. Also assume that the last address where an error was detected is FA003 hex (1024003 decimal), and that the pattern sent was 75 hex and the pattern received was 4 hex (75 XOR 04 = 71 hex = 113 decimal). In addition, assume that at an earlier address the most significant data bit contained an error. This gives the data bit history a value of F1 hex (71 OR 80 = F1 hex = 241 decimal). In this case, the TCS responds with:

⟨ESC⟩[>8;3;2;1024003;113;241n

Request Touch Panel Test Report Command {FRTTR} (Remote)

The Request Touch Panel Test Report command allows the host to obtain detailed results of touch panel testing during the Continuous Integrity Test or automatic self-testing. The host receives a response from this command while the Continuous Integrity Test is in progress only if the Continuous Integrity Test was activated by the host rather than locally by the user.

The TCS responds to the Request Touch Panel Test Report command by sending to the host the Touch Panel Test results obtained since the Continuous Integrity Test started or since the TCS was last powered-up or reset.

DEFAULT

The test results are always reinitialized to zero at the start of the Continuous Integrity Test, when power is applied, or when the TCS is reset.

OPERATOR USAGE

None. (This is a remote command only.)

HOST USAGE

⟨ESC⟩ [⟩ 9 n

The TCS responds with:

⟨ESC⟩ [⟩ 9 ; ⟨Ploops⟩ ; ⟨Pfail⟩ ; ⟨Perror⟩ n

⟨Ploops⟩ indicates the number of Touch Panel Tests completed since the Continuous Integrity Test started or since the TCS was last powered-up or reset.

⟨Pfail⟩ indicates the number of Touch Panel Tests that detected a failure since the Continuous Integrity Test started or since the TCS was last powered-up or reset.

⟨Perror⟩ is the decimal equivalent of the most recent touch cell closure (if the Touch Panel Closure Test was performed) or the decimal equivalent of the exclusive-OR of the most recent Touch Panel Loopback data sent and received (if the Touch Panel Loopback Test was performed).

NOTE

⟨Perror⟩ may indicate either a touch cell closure or a comparison of data sent and received during a Touch Panel Loopback Test.

The meaning of ⟨Perror⟩ is determined by whether the most recent test that resulted in the error was the result of a Touch Panel Loopback Test or a Touch Panel Closure Test. At power-up, only a Test Panel Closure Test is performed. But, if the Continuous Integrity Test is initiated by the host, either type of touch panel test may be specified.

POSSIBLE ERRORS

Touching the touch panel during this test will cause an error.

EXAMPLES

〈ESC〉[> 9 n

This control string from the host requests a Touch Panel Test report. If only a power-up test has been performed and no touch panel errors were detected, the TCS responds with:

〈ESC〉[> 9 ; 1 ; 0 ; 0 n

If the Continuous Integrity Test has completed 12 loops and detected touch panel closure errors during 5 of those test loops and the most recent cell in error was 108, the TCS responds with:

〈ESC〉[> 9 ; 1 2 ; 5 ; 1 0 8 n

Assume that the Continuous Integrity Test has completed 3 loops and detected Touch Panel Loopback errors during 1 of those loops. Also assume that the most recent data sent was 8FE hex and the most recent data received was FFF hex. Since 8FE XOR FFF = 701 hex = 1793 decimal, the TCS in this case responds with:

〈ESC〉[> 9 ; 3 ; 1 ; 1 7 9 3 n

Section 9
Sample Programs

INTRODUCTION

This section provides sample programs that illustrate how to program the Touch Control Screen (TCS) from typical host computers.

SAMPLE PROGRAM USING THE FLUKE 1722A OR 1752A

The program listed in Table 9-1 demonstrates how to create functioning touchkeys on the TCS using a Fluke 1722A Instrument Controller or 1752A Data Acquisition System as the host computer. To connect the TCS to the host computer, and enter and run the program, execute the following steps:

1. Connect the TCS to the KB1: port on a Fluke 1722A or 1752A using a null-modem cable. The wiring for the accessory Y1062 Null-Modem cable is shown in Figure 9-1.
2. Power up the TCS.
3. Select the following communications parameters:

baud rate	9600
data bits	8
parity enable	off
stop bits	1

4. Press EXIT on the touch panel or press the Setup key on the optional keyboard to exit the Setup Screen.
5. Power up the 1722A or 1752A.
6. The display prompt will read "FDOS>". Enter the Set Utility Program by typing:

   SET

7. The display prompt will read "SET>". Set the following parameters for KB1:

   BR 9600
   DB 8
   PB NONE
   SB 1
   EOL 13
   SI E
   SO E

8. Exit the Set Utility Program by typing:

   ex

9. The display prompt will again read "FDOS⟩". Enter interpreted BASIC by typing:

   BASIC

10. Type in the program listed in Table 9-1.

11. Exit the editor by typing:

    ⟨Ctrl/C⟩

12. To run the program, type:

    RUN

13. Touch each of the touchkeys on the display. When any touchkey is pressed, the TCS beeps and the touchkey lights up.

Table 9-1. Sample Program Using the Fluke 1722A or 1752A

```
1000 !*****************************************
1010 !
1020 !      setup constants
1030 !
1040 ES$ = CHR$(27)                                  ! Escape string introducer
1050 DIM P$(3)                                       ! Define array for cursor
1060 !                                               !    positioning
1070 P$(1) = ES$ + "[7;5H"                           ! Position of first target
1080 P$(2) = ES$ + "[7;17H"                          ! Position of second target
1090 P$(3) = ES$ + "[7;29H"                          ! Position of third target
1100 OV% = 0%                                        ! Last target touched flag
1110 !
1120 ! Table of active touch cells
1130 DF$ = SPACE$(30) + " 11 22 33  11 22 33  11 22 33 " + SPACE$(60)
1140 !
1150 !*****************************************
1160 !
1170 !      open serial communication channels to terminal
1180 !
1190 CLOSE 1%                                        ! Make sure selected channels
1200 CLOSE 2%                                        !      not previously open
1210 !
1220 OPEN "KB1:" AS NEW FILE 1%                      ! Open output channel
1230 OPEN "KB1:" AS OLD FILE 2%                      ! Open input channel
1240 !
1250 !*****************************************
1260 !
1270 !      setup terminal modes and attributes
1280 !
1290 PRINT #1, ES$;"[2J";                            ! Clear screen
1300 PRINT #1, ES$;"[;;13w";                         ! Set terminator chr to (CR)
1310 PRINT #1, ES$;"[>1l";                           ! No Polled Touch Mode
1320 PRINT #1, ES$;"[2h";                            ! Keyboard Lock-Out
1330 PRINT #1, ES$;"[m";                             ! Turn attributes off
1340 PRINT #1, ES$;"[>3l";                           ! Turn off NOCHANGE attribute
1350 PRINT #1, ES$;"[>2l";                           ! Enable touch input
1360 PRINT #1, CHR$(15);                             ! Standard character set
1370 PRINT #1, ES$;"[12l";                           ! Local Echo off
1380 PRINT #1, ES$;"[20l";                           ! New Line Mode off
1390 PRINT #1, ES$;"[7z";                            ! Clear inputs
1400 PRINT #1, ES$;"[1;0u";                          ! Turn auto-beep off
1410 PRINT #1, ES$;"[1v";                            ! Turn off cursor
1420 PRINT #1, ES$;"[1;1H";                          ! Position cursor
1430 PRINT #1, ES$;"#3";                             ! Top of double-size line
1440 PRINT #1, ES$;"[2;1H";                          ! Position cursor
1450 PRINT #1, ES$;"#4";                             ! Bottom of double-size line
1460 PRINT #1, ES$;"[5;1H";                          ! Position cursor
1470 !
1480 FOR I% = 1% TO 19%
1490   PRINT #1, ES$;"#6"                            ! Double-width lines
1500   NEXT I%
1510 !
```

Table 9-1. Sample Program Using the Fluke 1722A or 1752A (cont)

```
1520 !****************************************
1530 !
1540 !     create display
1550 !
1560 PRINT #1, ES$;"[1;11H";                    ! Position cursor
1570 PRINT #1, "Touch Control Screen";           ! Top of double-size line
1580 PRINT #1, ES$;"[2;11H";                    ! Position cursor
1590 PRINT #1, "Touch Control Screen";          ! Bottom of double-size line
1600 !
1610 PRINT #1, ES$;"[5;3H";                     ! Position cursor
1620 PRINT #1, ES$;"[6;10;36;2t";               ! Draw outline
1630 !
1640 PRINT #1, P$(1);                           ! Position cursor
1650 PRINT #1, ES$;"[6;6;8;4t";                 ! Draw first target
1660 PRINT #1, P$(2);                           ! Position cursor
1670 PRINT #1, ES$;"[6;6;8;4t";                 ! Draw second target
1680 PRINT #1, P$(3);                           ! Position cursor
1690 PRINT #1, ES$;"[6;6;8;4t";                 ! Draw third target
1700 !
1710 PRINT #1, ES$;"[9;7H";                     ! Position cursor
1720 PRINT #1, "ONE";                           ! First target label
1730 PRINT #1, ES$;"[9;19H";                    ! Position cursor
1740 PRINT #1, "TWO";                           ! Second target label
1750 PRINT #1, ES$;"[9;30H";                    ! Position cursor
1760 PRINT #1, "THREE";                         ! Third target label
1770 !
1780 PRINT #1, ES$;"[20;7H";                    ! Position cursor
1790 PRINT #1, "A light touch is all it takes."; ! Print text
1800 !
1810 !****************************************
1820 !
1830 !     Get user input
1840 !
1850 INPUT #2,A$                                ! Get touch input from user
1860 !
1870 K% = VAL(MID(A$,6,3))                      ! Extract touch cell number
1880 NT% = VAL(MID(DF$,K%,1))                   ! Check against validity table
1890 IF NT% = 0% THEN GOTO 1850                 ! Determine if a valid touch
1900 PRINT #1, CHR$(7)                          ! Beep if valid touch
1910 !
1920 IF OV% = 0% THEN GOTO 1950                 ! Determine if first use
1930   PRINT #1, P$(OV%);                       ! Go to prior touched target
1940   PRINT #1, ES$;"[7;6;8;1t";               ! Remove reverse video attrib.
1950 PRINT #1, P$(NT%);                         ! Go to last touched target
1960 PRINT #1, ES$;"[7m";                       ! Set reverse video attribute
1970 PRINT #1, ES$;"[7;6;8;1t";                 ! Fill in target
1980 PRINT #1, ES$;"[m";                        ! Reset attributes
1990 OV% = NT%                                  ! Last key is now previous key
2000 GOTO 1850
2010 !
2020 END
```

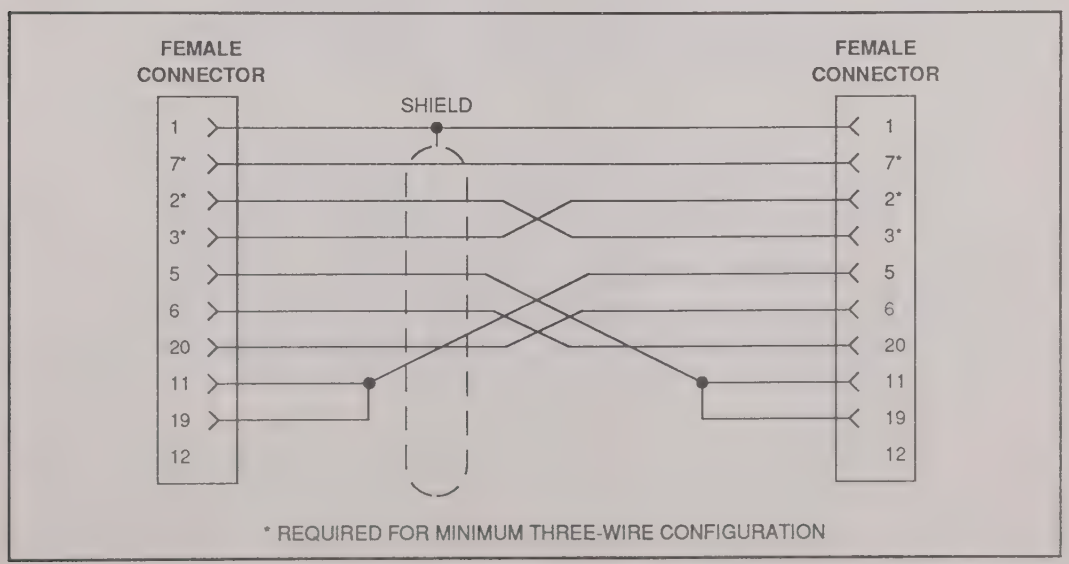


Figure 9-1. Null-Modem Cable

SAMPLE PROGRAM USING THE IBM PC OR IBM XT (IN BASICA)

The program listed in Table 9-2 demonstrates how to create functioning touchkeys on the TCS using BASICA with an IBM PC or IBM XT as the host computer. To connect the TCS to the host computer, and input and run the program, execute the following steps:

1. Connect the TCS to the KB1: port on a Fluke 1722A or 1752A using the Fluke Y1062 Null-Modem cable. The wiring of the Y1062 is illustrated in Figure 9-1.

2. Power up the TCS.

3. Select the following communications parameters on the TCS:

baud rate	9600
data bits	8
parity enable	off
stop bits	1

4. Press EXIT on the touch panel or the Setup key on the optional keyboard to exit the Setup Screen.

5. Power up the IBM PC or IBM XT.

6. Enter BASICA by typing:

   BASICA

7. Type in the program listed in Table 9-1.

8. To run the program, type:

   RUN

9. Touch each of the touchkeys on the display. The TCS will beep and the touchkey will light up when pressed.

NOTE

This program can be run on the IBM PC or IBM XT using BASICA. With a minor modification (explained in text), this program can also be run on the IBM PC, IBM XT, or IBM AT using BASIC.

SAMPLE PROGRAM USING THE IBM PC, IBM XT, OR IBM AT (IN BASIC)

The program in Table 9-2 also demonstrates how to create functioning touchkeys on the TCS using BASIC with an IBM PC, IBM XT, or IBM AT a the host computer. To connect the TCS to the host computer, and input and run tl program, execute the following steps:

1. Connect the TCS to the COM1: port on the computer using the Fluke Y1062 Null Modem cable. The wiring of the Y1062 is illustrated in Figure 9-1.

2. Power up the TCS.

3. Select the following communications parameters on the TCS:

baud rate	9600
data bits	8
parity enable	off
stop bits	1

4. Press EXIT on the touch panel or the Setup key on the optional keyboard to exit the Setup Screen.

5. Power up the IBM PC, IBM XT, or IBM AT.

6. Enter BASIC by typing:

   BASIC

   or, if available by typing:

   BASICA

7. Type in the program listed in Table 9-2.

8. Delete the following lines from the program listing:

   255 ON COM(1) GOSUB 730
   260 COM(1) ON
   550 COM(1) OFF

   These lines are not needed and will cause syntax errors when using BASIC.

9. To run the program, type:

   RUN

10. Touch each of the touchkeys on the display. The TCS will beep and the touchkey will light up when pressed.

Table 9-2. Sample Program Using the IBMPC, IBMXT or IBMAT

```
100 '*****************************************
105 '
110 '    Set up constants
115 '
120 ES$ = CHR$(27)                                  ' Control string introducer
125 DIM P$(3)                                       ' Define array for cursor
130 '                                               '    positioning
135 P$(1) = ES$ + "[7;5H"                           ' Position of first target
140 P$(2) = ES$ + "[7;17H"                          ' Position of second target
145 P$(3) = ES$ + "[7;29H"                          ' Position of third target
150 XOFF = 19                                       ' ASCII for XOFF
155 XON = 17                                        ' ASCII for XON
160 ' Table of active touch cells
165 DF$ = SPACE$(30) + " 11 22 33  11 22 33  11 22 33 " + SPACE$(60)
170 '
175 '*****************************************
180 '
185 '    Initialize variables
190 '
195 PAUSE% = 0                                      ' XON/XOFF flag 1 = XOFF
200 LT% = 0                                         ' Last touch-cell value
205 A$ = ""                                         ' Input from TCS
210 NT% = 0                                         ' New touch-cell value
215 '
220 '*****************************************
225 '
230 '    Open serial communication channels to TCS
235 '
240 CLOSE                                           ' Close com. channels
245 OPEN "COM1:9600,N,8,1" AS #1                    ' Open communications port
250 '
255 ON COM(1) GOSUB 730                             ' Set up interrupt routine
260 COM(1) ON                                       ' Turn on interrupts
265 '
270 '*****************************************
275 '
280 '    Set up TCS modes and attributes
285 '
290 PRINT #1, ES$;"[;;13w";                         ' Set terminator chr to <CR>
295 PRINT #1, ES$;"[>11";                           ' Polled touch mode off
300 PRINT #1, ES$;"[m";                             ' Turn attributes off
305 PRINT #1, ES$;"[>31";                           ' Change attribute mode
310 PRINT #1, ES$;"[>21";                           ' Enable touch input
315 PRINT #1, CHR$(15);                             ' Standard character set
320 PRINT #1, ES$;"[12h";                           ' Local Echo mode off
325 PRINT #1, ES$;"[20h";                           ' New Line mode on
330 PRINT #1, ES$;"[1;0u";                          ' Turn auto-beep off
335 PRINT #1, ES$;"[1v";                            ' Turn off cursor
340 PRINT #1, ES$;"[2J";                            ' Clear screen
345 '
350 PRINT #1, ES$;"[1;1H";                          ' Position cursor
355 PRINT #1, ES$;"#3";                             ' Top of double-sized line
360 PRINT #1, ES$;"[2;1H";                          ' Position cursor
365 PRINT #1, ES$;"#4";                             ' Bottom of double-sized line
370 '
375 PRINT #1, ES$;"[5;1H";                          ' Position cursor
380 FOR I% = 1 TO 19                                ' Create double wide region
385   PRINT #1, ES$;"#6";                           ' Double-width lines
390   PRINT #1,ES$;"[B";                            ' Move down one line
395   NEXT I%
400 '
405 '*****************************************
410 '
415 '    Create display
420 '
425 PRINT #1, ES$;"[1;11H";                         ' Position cursor
430 PRINT #1, "Touch Control Screen";               ' Top of double-sized line
435 PRINT #1, ES$;"[2;11H";                         ' Position cursor
440 PRINT #1, "Touch Control Screen";               ' Bottom of double-sized line
```

Table 9-2. Sample Program Using the IBMPC, IBMXT or IBMAT (cont)

```
445 '
450 PRINT #1, ES$;"[5;3H";                          ' Position cursor
455 PRINT #1, ES$;"[6;10;36;2t";                    ' Draw outline
460 '
465 PRINT #1, P$(1);                                ' Position cursor
470 PRINT #1, ES$;"[6;6;8;4t";                      ' Draw first target
475 PRINT #1, P$(2);                                ' Position cursor
480 PRINT #1, ES$;"[6;6;8;4t";                      ' Draw second target
485 PRINT #1, P$(3);                                ' Position cursor
490 PRINT #1, ES$;"[6;6;8;4t";                      ' Draw third target
495 '
500 PRINT #1, ES$;"[9;7H";                          ' Position cursor
505 PRINT #1, "ONE";                                ' Label first target
510 PRINT #1, ES$;"[9;19H";                         ' Position cursor
515 PRINT #1, "TWO";                                ' Label second target
520 PRINT #1, ES$;"[9;30H";                         ' Position cursor
525 PRINT #1, "THREE";                              ' Label third target
530 '
535 PRINT #1, ES$;"[20;7H";                         ' Position cursor
540 PRINT #1, "A light touch is all it takes.";     ' Print text
545 '
550 COM(1) OFF                                      ' Disable interrupts
555 '
560 '*****************************************
565 '
570 '    Get user input
575 '
580 PRINT #1, ES$;"[7z";                            ' Clear inputs
585 INPUT #1, A$                                    ' Get touch input from TCS
590 '
595 WHILE ASC(MID$(A$,1,1)) < 32                    ' Check for non printable
600                                                 '   character
605   A$ = MID$(A$,2,LEN(A$) - 1)                   ' Remove that character
610   WEND
615 '
620 CELL% = VAL(MID$(A$,5,3))                       ' Extract cell touched
625 NT% = VAL(MID$(DF$,CELL%,1))                    ' Check against validity table
630 IF NT% = 0 THEN GOTO 585                        ' Determine if a valid touch
635 PRINT #1, CHR$(7)                               ' Beep on valid touch
640 '
645 '    Update the display
650 IF LT% = 0 THEN GOTO 665                        ' Determine if first use
655   PRINT #1, P$(LT%);                            ' Go to prior touched target
660   PRINT #1, ES$;"[7;6;8;1t";                    ' Remove reverse-video attrib.
665 PRINT #1, P$(NT%);                              ' Go to last touched target
670 PRINT #1, ES$;"[7m";                            ' Set reverse-video attrib.
675 PRINT #1, ES$;"[7;6;8;1t";                      ' Fill in target
680 PRINT #1, ES$;"[0m";                            ' Reset attributes
685 LT% = NT%                                       ' Last touch is now new touch
690 GOTO 580                                        ' Start over
695 END
700 '
705 '*****************************************
710 '
715 ' Software handshake routine
720 '
725 ' If the TCS sends an XOFF, this routine delays output until an
730 ' XON is received from the TCS.
735 '
740 WHILE NOT EOF(1)
745   A$ = INPUT$(LOC(1),#1)                        ' Read input from TCS
750   FOR I = 1 TO LEN(A$)                          ' Check each character
755     CMD = ASC(MID$(A$,I,1))                     ' Get char from input
760     IF CMD = XOFF THEN PAUSE% = 1               ' Check for XOFF
765     IF CMD = XON THEN PAUSE% = 0                ' Check for XON
770     NEXT I                                      ' Throw away other input
775   WEND
780 IF PAUSE% = 1 THEN GOTO 740                     ' Loop if XOFF
785 RETURN
```

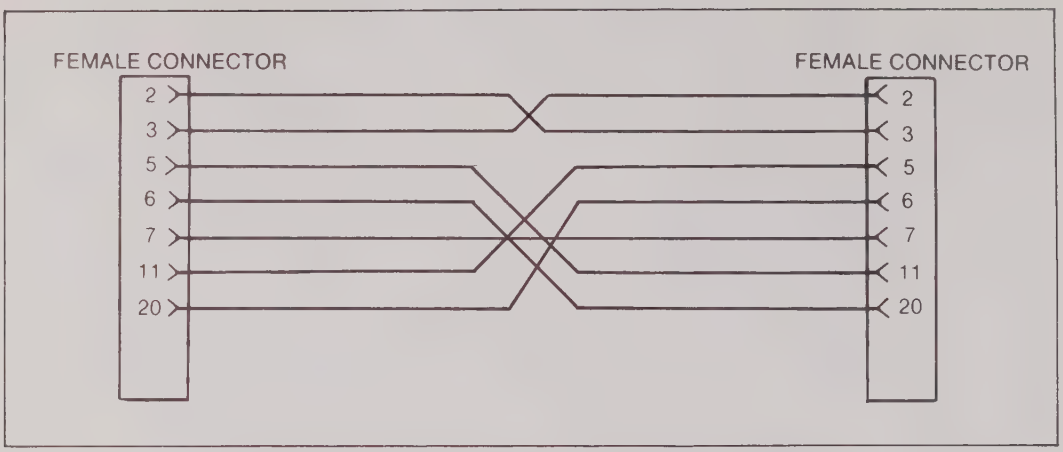


Figure 9-2. Handshaking Cable for IBMPC, IBMXT or IBMAT

Appendix A
Glossary

address

A coded number representing the location of an item. Examples include bus address and program address.

Alignment Screen

Display screen used to realign the horizontal and vertical position of the display on the face of the CRT to match the overlying touch panel. The Alignment Screen is accessed from the Setup Screen.

ANSI

American National Standards Institute, Inc., a group that develops and publishes industry standards.

application software

A program running on a host computer designed to perform specified functions in a working environment.

ASCII

American Standard Code for Information Interchange as defined by ANSI document X3.4-1977. ASCII is a standardized code set for 128 characters, including full alphabetic (upper and lower case), numerics, punctuation, and a set of control characters.

asynchronous data

Information transmitted or received at random times with respect to a particular system. In terminals, asynchronous data usually consists of one character at a time, and at predefined, self-clocking baud rates. See also synchronous data.

baud rate

The serial transfer rate in bits per second including all framing bits used to identify the start and end of characters or messages.

binary

A number system based on zero (0) and one (1) representations, often used to represent data or instruction codes. In binary there are only two numbers, so digital computers can use binary for their operation because each number can be represented as the state (on or off) of a transistor.

bit

A contraction of binary digit. A bit is either a 1 or a 0 and represents the smallest single unit of computer information. Bits are often used in groups of seven or eight to represent characters.

boxtypes

Graphics characters used by the TCS to draw rectangular boxes on the screen. Boxtypes are used to create touchkeys.

break

A communication signal that can be recognized at any baud rate. The TCS generates a short break when the Break key on the optional keyboard is pressed, and a long break when Shift/Break is pressed. The TCS ignores any break it receives. See also short break and long break.

buffer

A storage location for information.

byte

A grouping of bits that represent a single character.

character cell

A portion of the display 8 pixels wide by 10 pixels high that is used to display a character. The TCS has 1920 character cells arranged in 24 lines of 80 characters.

character set

The character set includes the upper-case and lower-case alphabet, the ten numerals, punctuation, graphic characters, boxtypes, international characters, and control characters.

character string

A grouping of characters.

control character

A nonprintable character used to produce a specific action such as a carriage return or line feed, or halting and restarting scrolling.

control sequence

An ANSI X3.64-1979 or ANSI-compatible sequence of ASCII characters that produces a desired display effect such as cursor position or reverse video.

Control Sequence Introducer

Special characters that cause the characters following it to be interpreted as an ANSI-standard or ANSI-compatible control sequence.

CPU

Central processing unit, the controlling instruction and data processor in any computer system. In the TCS, the CPU is a 68008 microprocessor with its supporting components located on the logic board.

CRT

Cathode-ray tube, the display screen on the front of the TCS.

CTS

Clear to Send, a signal used in RS-232-C communication. The TCS will not transmit data if CTS is off (low).

cursor

The visible pointer on the CRT display that indicates to the user the position where the next character will appear.

data

Normally refers to information that has been collected for interpretation by a program.

DCE

Data communication equipment as described by the EIA Standard RS-232-C. Modems and null-modem cables are examples of DCE. As specified by RS-232-C, in order to make a communications link, DCE must be connected to data terminal equipment (DTE).

default value

The parameter value that is assumed when no explicit value, or sometimes a value of 0, is specified.

display

The area on the CRT that can display character cells.

DSR

Data Set Ready, a signal used in RS-232-C communication. The TCS does not transmit characters to the host unless the DSR signal is on (high).

DTE

Data terminal equipment as described by the EIA Standard RS-232-C. The TCS is an example of DTE. As specified by RS-232-C, in order to make a communications link, DTE must be connected to data communication equipment (DCE).

DTR

Data Terminal Ready, a signal used in RS-232-C communication. The TCS sets the DTR signal on (high) when it is ready to begin communication with the host. DTR is subsequently set off (low) only during a long break or reset.

EIA

Electronic Industries Association, publisher of standards RS-232-C and RS-422-A for binary serial data communication.

EPROM

Erasable Programmable Read Only Memory. A memory device that can be erased with ultraviolet light and reprogrammed using specialized equipment.

escape sequence

A string of ASCII characters beginning with the escape character ⟨ESC⟩. These strings generally convey special programming and control information between the host and the TCS when sent over the serial port. (This is also called a control sequence).

Extended Characters

Characters in the upper half (128 positions) of the 256-character set.

firmware

Computer programs and data that are recorded in permanent memory. See ROM.

handshaking

A method by which data is exchanged between devices only when each device has signaled that it is ready.

hard reset

A reset command executable only by the host computer that returns all the parameters of the TCS to their factory-programmed default values. The TCS then undergoes a normal power-up sequence.

hexadecimal

A number system based on 16 digits. Sometimes called hex, the system uses 0 through 9, and A, B, C, D, E, and F, to represent the digits above 9.

host

A separate product or system (usually a computer) that interacts with the TCS through the RS-232-C serial interface.

input buffer

The buffer within the TCS containing characters received from the host.

interface

A hardware and software connection of devices within a system.

LED

Light-emitting diode. Used as indicators on the Scroll Lock and Caps Lock keys on the optional keyboard. The LEDs are lit when the keys are locked and off when the keys are unlocked.

long break

A communication disruption sent by the TCS when the optional keyboard keys Shift/Break are pressed. A long break sets the DTR and RTS signals low for 3.5 seconds.

NEMA

National Electrical Manufactures Association. Publishers of various standards, including the NEMA 12 standard that describes dust-proof and water-resistant enclosures.

non-volatile memory

An electronic memory that retains its contents when power is turned off. The TCS uses non-volatile memory to store programmable characteristics of the TCS between operating sessions.

NRC

National Replacement Code. One of several standardized codes whereby some standard ASCII codes are displayed as characters particular to a given nationality's language.

mnemonic

From the technique used to help a person memorize information, an abbreviated name for something. Examples of mnemonics are "XON" and "XOFF", for "transmit-on" and "transmit-off".

output buffer

The buffer within the TCS containing characters to be sent to the host.

parallax

An optical effect that occurs when viewing two objects at different distances from different angles. For example, the distance from the surface of the touch panel to the image on the tube, when viewed from an angle, can cause the user to misread the location of a visual target relative to the touch panel. This is parallax error.

parameter

An adjustable operating feature. Examples of parameters of the TCS include baud rate, cursor type, and light or dark background.

parameter string

A set of values within a control string that defines exactly how the control string should be interpreted by the TCS.

parity

A method of error detection that uses one extra bit for each unit of information (such as a byte). The parity bit is set to 1 or 0 so that the total number of 1s in the byte, together with the parity bit, is even or odd.

pixel

Acronym for picture element; the smallest amount of visual information that the display is able to resolve; one dot.

port

A connection point used for data transfer. See interface.

power-up sequence

The sequence of events after power is applied until the TCS is ready to assume full functional operation under the command of the user and/or host.

program

Any meaningful sequence of computer instructions that causes a system to accomplish a task.

PROM

Programmable Read Only Memory, a memory device that can be programmed using specialized equipment.

protocol

A set of rules for exchange of information between systems or devices.

RAM

Random-access memory. Through common usage, the term has come to mean the high-speed volatile semiconductor memory that is normally used for system and user memory. It is memory, both readable and writeable, used to store and recall information.

raster

The scanning pattern of an electron beam on a CRT display. A raster display uses the same scan pattern all the time, forming images by turning the beam on and off at appropriate times.

RLSD

Received Line Signal Detect, a signal used in RS-232-C communication. The TCS ignores data when RLSD is off (low).

ROM

Read-only memory. A memory used for permanently recorded computer programs and data.

RS-232-C

A digital communication standard agreed upon by participating manufacturers of data communication equipment for the transfer of serial digital data between data communication equipment (DCE) and data terminal equipment (DTE). The TCS is a DTE device. The standard is published and maintained by the Electronic Industries Association (EIA).

RS-422-A

An Electronic Industries Association (EIA) data communication standard that specifies two balanced-voltage signal lines that are independent of signal ground for each data channel. With RS-422-A, two pairs of balanced lines carry the data as a differential signal. This offers longer distance and higher signaling rates for direct-connect use than RS-232-C.

RTS

Request to Send, a signal used in RS-232-C communication. The TCS sets RTS on (high) whenever it can support communication with the host.

serial data

Information transmitted one bit at a time at a predefined baud rate.

serial port

A physical connector for transmitting and receiving serial data. The TCS uses the industry standard D-type connector for an RS-232-C interface.

Setup Screen

Display screen used to change various TCS parameters, and used to call up the Test and Alignment Screens. The Setup Screen may be entered by pressing the Set Up key on the optional keyboard or the SET UP switch on the rear panel (if accessible).

short break

A communication disruption sent by the TCS when the Break key on the optional keyboard is pressed. A short break sets the Transmit Data (TD) signal low for 300 milliseconds. The host recognizes a short break regardless of its baud rate setting.

soft reset

A reset command executable by the user through the Setup Screen or the host via a remote command that returns all the parameter values of the TCS to the last saved configuration. The TCS then undergoes a normal power-up sequence.

software

Computer programs and data recorded and used on a medium that can be erased and rewritten by program command.

SRTS

Secondary Request to Send, a signal used in RS-232-C communication. The TCS sets this signal off (low) when it sends the XOFF character to the host, and it sets SRTS on (high; the normal state) when it sends the XON character.

Standard Characters

Characters in the lower half (128 positions) of the 256-character set.

synchronous data

Digital information transmitted in predetermined message block sizes with a clock signal to synchronize the receiver to the transmitter. See also asynchronous data.

system

An interconnection of instruments or other devices.

target

A visual image displayed on the screen, perceived by the user as a single box, icon, group of characters, or other graphic symbol. A target indicates a location for the user to touch the screen.

TCS

The Touch Control Screen; this product, consisting primarily of a display screen and touch panel.

Test Screen

Display screen used to perform user-initiated tests of the TCS. The Test Screen is accessed from the Setup Screen.

touch cell

An individual physical switch on the touch panel. The touch panel on the TCS has 120 touch cells arranged in 12 rows by 10 columns.

touchkey

A group of one or more touch cells in conjunction with a visual target that work together as a command entry point for the user. All touch cells in the group are defined by the programmer as a touchkey, so the program recognizes an input from any of the touch cells as the same entry.

touch panel

The transparent overlay residing in front of the display, that detects physical touch against areas of the display.

UART

Universal Asynchronous Receiver-Transmitter. An integrated circuit that performs serial transmission and reception of information over a communication link.

XOFF

"Transmit-off" character sent to signal that transmission of data should be stopped from a source to a destination. This character is an ASCII ⟨DC3⟩ (decimal 19, hex 13). The XOFF character is sent to the host when the user types Ctrl/S on the optional keyboard or when the input buffer is full.

XON

"Transmit-on" character sent to signal that transmission of data is allowed from a source to a destination. This character is an ASCII ⟨DC1⟩ (decimal 17, hex 11). The XON character is sent to the host when the user types Ctrl/Q on the optional keyboard or when the input buffer again has room.

Appendix B
Character Sets

STANDARD CHARACTERS

COLUMN

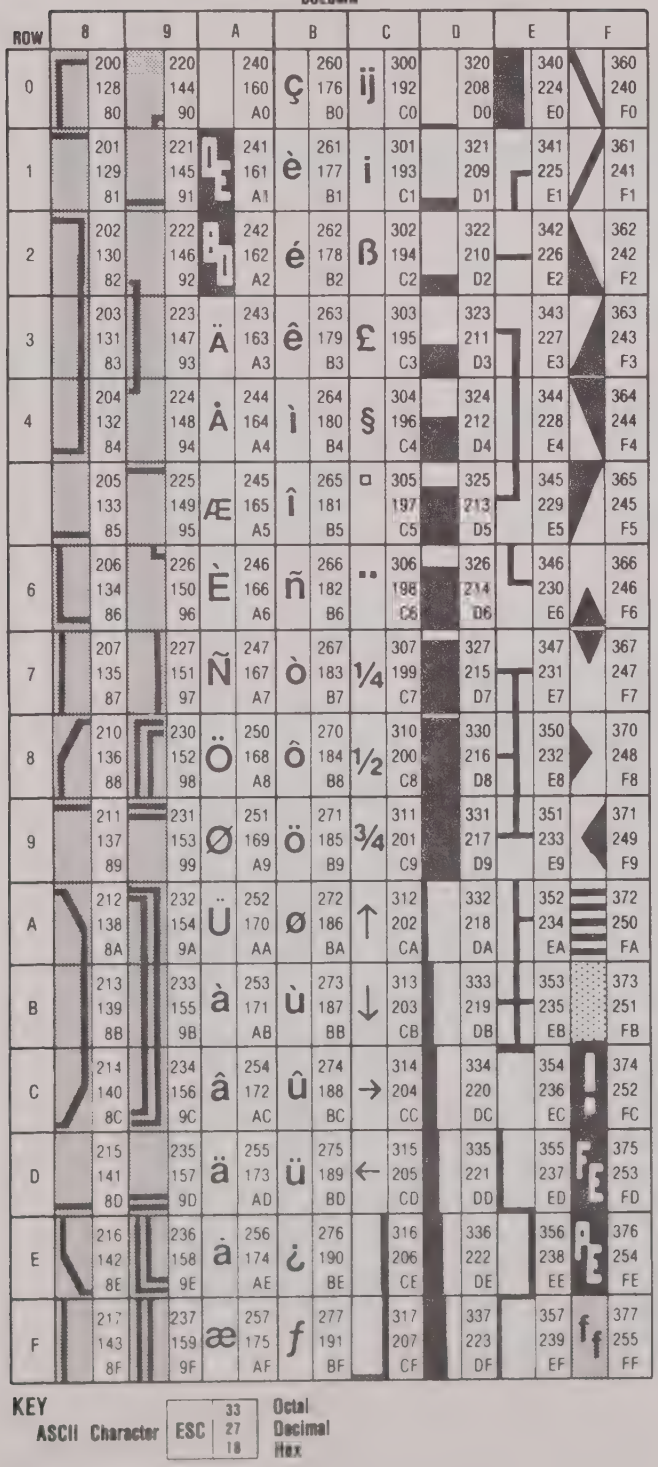
ROW	0		1		2		3		4		5		6		7	
0	NUL	00 00 00	DLE	20 16 10		40 32 20	0	60 48 30	@	100 64 40	P	120 80 50	`	140 96 60	p	160 112 70
1	SOH	01 01 01	DC1	21 17 11	!	41 33 21	1	61 49 31	A	101 65 41	Q	121 81 51	a	141 97 61	q	161 113 71
2	STX	02 02 02	DC2	22 18 12	"	42 34 22	2	62 50 32	B	102 66 42	R	122 82 52	b	142 98 62	r	162 114 72
3	ETX	03 03 03	DC3	23 19 13	#	43 35 23	3	63 51 33	C	103 67 43	S	123 83 53	c	143 99 63	s	163 115 73
4	EOT	04 04 04	DC4	24 20 14	$	44 36 24	4	64 52 34	D	104 68 44	T	124 84 54	d	144 100 64	t	164 116 74
5	ENQ	05 05 05	NAK	25 21 15	%	45 37 25	5	65 53 35	E	105 69 45	U	125 85 55	e	145 101 65	u	165 117 75
6	ACK	06 06 06	SYN	26 22 16	&	46 38 26	6	66 54 36	F	106 70 46	V	126 86 56	f	146 102 66	v	166 118 76
7	BEL	07 07 07	ETB	27 23 17	'	47 39 27	7	67 55 37	G	107 71 47	W	127 87 57	g	147 103 67	w	167 119 77
8	BS	10 08 08	CAN	30 24 18	(	50 40 28	8	70 56 38	H	110 72 48	X	130 88 58	h	150 104 68	x	170 120 78
9	HT	11 09 09	EM	31 25 19	)	51 41 29	9	71 57 39	I	111 73 49	Y	131 89 59	i	151 105 69	y	171 121 79
A	LF	12 10 0A	SUB	32 26 1A	*	52 42 2A	:	72 58 3A	J	112 74 4A	Z	132 90 5A	j	152 106 6A	z	172 122 7A
B	VT	13 11 0B	ESC	33 27 1B	+	53 43 2B	;	73 59 3B	K	113 75 4B	[	133 91 5B	k	153 107 6B	{	173 123 7B
C	FF	14 12 0C	FS	34 28 1C	,	54 44 2C	<	74 60 3C	L	114 76 4C	\	134 92 5C	l	154 108 6C	¦	174 124 7C
D	CR	15 13 0D	GS	35 29 1D	-	55 45 2D	=	75 61 3D	M	115 77 4D	]	135 93 5D	m	155 109 6D	}	175 125 7D
E	SO	16 14 0E	RS	36 30 1E	.	56 46 2E	>	76 62 3E	N	116 78 4E	^	136 94 5E	n	156 110 6E	~	176 126 7E
F	SI	17 15 0F	US	37 31 1F	/	57 47 2F	?	77 63 3F	O	117 79 4F	_	137 95 5F	o	157 111 6F	DT	177 127 7F

NOTE

In this table, the value of a character in hex can be determined by its row and column position. The column number represents the 16's digit and the row number represents the 1's. For example, character G is specified as column 4, row 7. Therefore, the value of character G is 47 hex.

The shaded characters in this table show the ASCII mnemonics for the respective control codes; these mnemonics are never displayed.

EXTENDED CHARACTERS



NOTE

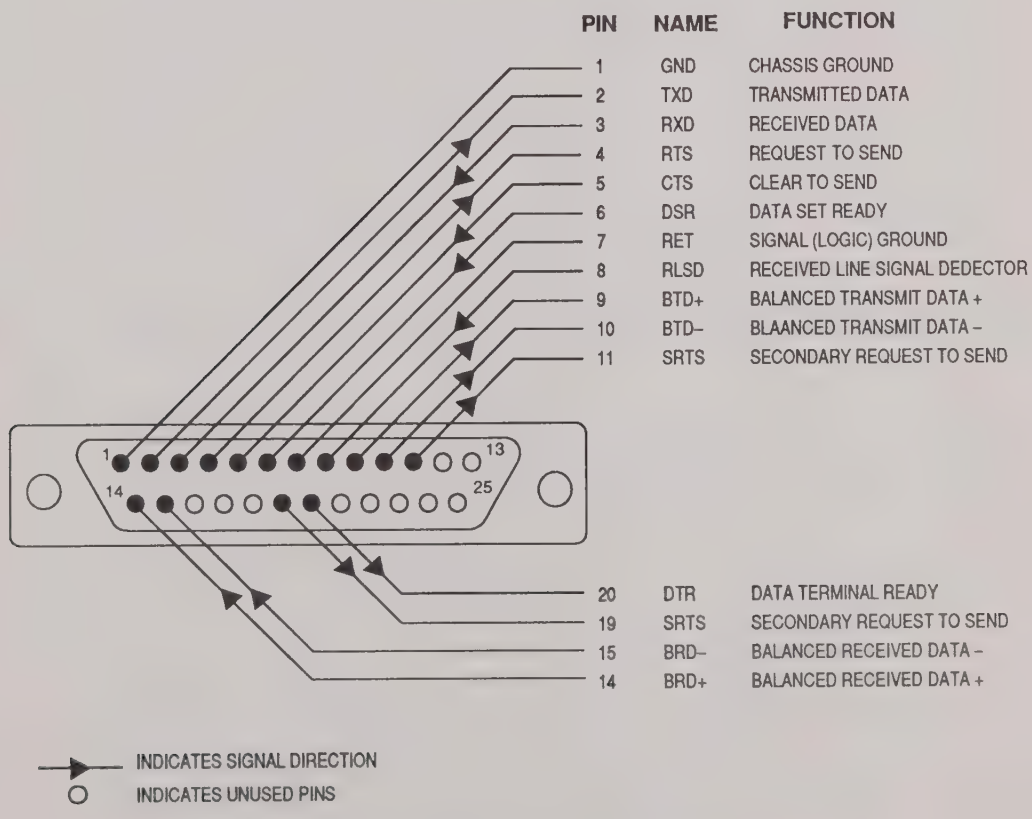
In this table, the value of a character in hex can be determined by its row and column position. The column number represents the 16's digit and the row number represents the 1's. For example, character **à** is specified as column A, row B. Therefore, the value of character **à** is AB hex.

The shaded characters in columns 8 and 9 contain Boxtype characters that can only be displayed by sending the Outline A Region command. The shaded character at location FF hex is never displayed.

Appendix C
RS-232-C and RS-422-A Pin Assignments

INTRODUCTION

This appendix describes the pin assignments for the rear panel RS-232-C connector. The connector supports both the RS-232-C and RS-422-A standards.



RS-232-C CONNECTOR REAR PANEL VIEW

Appendix D
Command Lookup Tables

INTRODUCTION

Appendix D contains three quick reference lookup tables for the Touch Control Screen (TCS) commands.

Each table provides commonly needed information about these command . Commands listed in these tables are fully documented in the indicated sections of this manual.

For versatility of reference, these tables are organized in three different ways:

- Table D-1 lists the commands alphabetically by command name and includes mnemonics (where applicable), source (user and/or host), and the page number where complete documentation of the command begins.
- Table D-2 lists the commands alphabetically by mnemonic and includes the command name, source (user and/or host), and the page number where complete documentation of the command begins.
- Table D-3 lists the commands in groups by related functions and includes mnemonics (where applicable), source (user and/or host), host usage (where applicable), TCS response (where applicable), and the section where each group of commands is documented.

The commands are grouped according to the following functions and are in the order in which they are discussed in this manual:

TCS Mode commands
Setup Screen commands
Communication commands
Character Displaying commands
Character Interpretation commands
Cursor commands
Screen Appearance commands
Region commands
Touch Panel commands
Keyboard commands
Status Reporting commands
Self-Test commands

NOTE

- *Mnemonics in square brackets [ ] are ANSI-specified commands.*
- *Mnemonics in braces { } are ANSI-compatible, Fluke-private commands.*
- *Mnemonics in parentheses ( ) are ANSI-compatible, DEC-private commands.*
- *Optional parameters are represented in angle brackets (e.g., ⟨Ps⟩).*

Table D-1. TCS Commands by Command Name

COMMAND NAME	MNEMONIC	SOURCE	PAGE
Auto Wrap-Around Mode	(DECAWM)	Local/Remote	5-15
Auto-Repeat Rate	{FARR}	Remote	6-16
Baud Rate		Local	4-15
Clear User Inputs	{FCUI}	Remote	4-23
Continuous Integrity Test	{FCIT}	Local/Remote	8-8
Cursor Type	{FCT}	Local/Remote	5-49
Data Bits		Local	4-16
Display Activity	{FDA}	Local/Remote	5-53
Display Double-Size Line	(DECDHL)	Remote	5-7
Display Double-Width Line	(DECDWL)	Remote	5-6
Display Normal Characters		Remote	5-4
Display Normal Line	(DECSWL)	Remote	5-8
Erase Character	[ECH]	Remote	5-9
Erase a Region	{FER}	Remote	6-6
Erase in Display	[ED]	Remote	5-12
Erase in Line	[EL]	Remote	5-10
Horizontal Alignment	{FHA}	Local/Remote	5-55
Index	[IND]	Remote	5-42
Keyboard Lockout Mode	[KAM]	Remote	7-9
Keypad Mode	(DECKPAM/DECKPNM)	Remote	7-10
Local/Remote Mode		Local	4-20
Modify Character Attributes in a Region	{FMCAIR}	Remote	6-11
Move Cursor Backward	[CUB]	Remote	5-38
Move Cursor Down	[CUD]	Remote	5-40
Move Cursor Forward	[CUF]	Remote	5-37
Move Cursor Up	[CUU]	Remote	5-39
Move Cursor to Absolute Position	[CUP]	Remote	5-35
National Replacement Code	{FNRC}	Local/Remote	5-23
New Line Mode	{LNM}	Local/Remote	5-17
Next Line	[NEL]	Remote	5-41
NOCHANGE Attribute Mode	{FNCAM}	Remote	5-20
Origin Mode	{DECOM}	Remote	5-32
Outline a Region	{FOR}	Remote	6-8

Table D-1. TCS Commands by Command Name (cont)

COMMAND NAME	MNEMONIC	SOURCE	PAGE
Parity Enable		Local	4-17
Parity Sense		Local	4-18
Polled Touch Mode	{FPTM}	Remote	6-14
Power-Up Interrupt Mode	{FPUIM}	Remote	8-3
Read Attributes Under Cursor	{FRAUC}	Remote	5-47
Read Character Under Cursor	{FRCUC}	Remote	5-46
Read Cursor Position	[CPR]	Remote	5-44
Read Touch Cell Status	{FRTS}	Remote	6-15
Recall Setup	{FRSU}	Local/Remote	4-11
Reporting Format	{FRF}	Remote	4-21
Request Non-Volatile Memory Test Report	{FRETR}	Remote	8-12
Request Power Status	{FRPS}	Remote	8-4
Request RAM Test Report	{FRRATR}	Remote	8-13
Request ROM Test Report	{FRRTR}	Remote	8-11
Request TCS Identification	[DA]	Remote	8-5
Request TCS Status	[DSR]	Remote	8-6
Request Touch Panel Test Report	{FRTTR}	Remote	8-15
Reset	[RIS]	Local/Remote	4-12
Reset Mode	[RM]	Remote	3-19
Reverse Index	[RI]	Remote	5-43
Save Setup	{FSSU}	Local/Remote	4-10
Scrolling Region	{DECSTBM}	Remote	5-30
Screen Background Mode	(DECSCNM)	Local/Remote	5-52
Select Character Set	[SCS]	Remote	5-18
Send Long Break		Local	7-12
Send-Receive Mode	[SRM]	Local/Remote	5-16
Send Short Break		Local	7-13
Set Character Attributes	[SGR]	Remote	5-28
Set Mode	[SM]	Remote	3-20
Setup Lockout Mode	{FSULM}	Remote	4-9
Stop Bits		Local	4-19
Touch Cell Audible Attribute	{FTAA}	Remote	6-18
Touch Panel Lockout Mode	{FTLM}	Remote	6-20
Vertical Alignment	{FVA}	Local/Remote	5-56
Vertical Refresh Rate		Local	5-57

Table D-2. TCS Commands Listed by Mnemonic (cont)

MNEMONIC	COMMAND NAME	SOURCE	PAGE
[CUB]	Move Cursor Backward	Remote	5-38
[CUD]	Move Cursor Down	Remote	5-40
[CUF]	Move Cursor Forward	Remote	5-37
[CUP]	Move Cursor to Absolute Position	Remote	5-35
[CUU]	Move Cursor Up	Remote	5-39
[DA]	Request TCS Identification	Remote	8-5
(DECAWM)	Auto Wrap-Around Mode	Local/Remote	5-15
(DECDHL)	Display Double-Size Line	Remote	5-7
(DECDWL)	Display Double-Width Line	Remote	5-6
(DECKPAM/DECKPNM)	Keypad Mode	Remote	7-10
{DECOM}	Origin Mode	Remote	5-32
(DECSCNM)	Screen Background Mode	Local/Remote	5-52
{DECSTBM}	Scrolling Region	Remote	5-30
(DECSWL)	Display Normal Line	Remote	5-8
[DSR]	Request TCS Status	Remote	8-6
[CPR]	Read Cursor Position	Remote	5-44
[ECH]	Erase Character	Remote	5-9
[ED]	Erase in Display	Remote	5-12
[EL]	Erase in Line	Remote	5-10
{FARR}	Auto-Repeat Rate	Remote	6-16
{FCIT}	Continuous Integrity Test	Local/Remote	8-8
{FCT}	Cursor Type	Local/Remote	5-49
{FCUI}	Clear User Inputs	Remote	4-23
{FDA}	Display Activity	Local/Remote	5-53
{FER}	Erase a Region	Remote	6-6
{FHA}	Horizontal Alignment	Local/Remote	5-55
{FMCAIR}	Modify Character Attributes in a Region	Remote	6-11
{FNCAM}	NOCHANGE Attribute Mode	Remote	5-20
{FNRC}	National Replacement Code	Local/Remote	5-23
{FOR}	Outline a Region	Remote	6-8
{FPTM}	Polled Touch Mode	Remote	6-14
{FPUIM}	Power-Up Interrupt Mode	Remote	8-3
{FRAUC}	Read Attributes Under Cursor	Remote	5-47
{FRCUC}	Read Character Under Cursor	Remote	5-46
{FRETR}	Request Non-Volatile Memory Test Report	Remote	8-12
{FRF}	Reporting Format	Remote	4-21
{FRSU}	Recall Setup	Local/Remote	4-11
{FRPS}	Request Power Status	Remote	8-4
{FRRATR}	Request RAM Test Report	Remote	8-13
{FRRTR}	Request ROM Test Report	Remote	8-11
{FRTS}	Read Touch Cell Status	Remote	6-15
{FRTTR}	Request Touch Panel Test Report	Remote	8-15
{FSSU}	Save Setup	Local/Remote	4-10
{FSULM}	Setup Lockout Mode	Remote	4-9
{FTAA}	Touch Cell Audible Attribute	Remote	6-18
{FTLM}	Touch Panel Lockout Mode	Remote	6-20
{FVA}	Vertical Alignment	Local/Remote	5-56

Table D-2. TCS Commands by Mnemonic (cont)

MNEMONIC	COMMAND NAME	SOURCE	PAGE
[IND]	Index	Remote	5-42
[KAM]	Keyboard Lockout Mode	Remote	7-9
[LNM]	New Line Mode	Local/Remote	5-17
[NEL]	Next Line	Remote	5-41
[RIS]	Reset	Local/Remote	4-12
[RI]	Reverse Index	Remote	5-43
[RM]	Reset Mode	Remote	3-19
[SCS]	Select Character Set	Remote	5-18
[SGR]	Set Character Attributes	Remote	5-28
[SM]	Set Mode	Remote	3-20
[SRM]	Send-Receive Mode	Local/Remote	5-16

Table D-3. Summary of Touch Control Screen Commands

COMMAND	MNEMONIC	SOURCE	HOST USAGE
TCS Mode Commands (Section 3)			
Reset Mode	[RM]	Remote	
For ANSI-specified modes:			<ESC> [<Ps> ; ... ; <Ps> l
For DEC-private modes:			<ESC> [? <Ps> ; ... ; <Ps> l
For Fluke-private modes:			<ESC> [> <Ps> ; ... ; <Ps> l
Set Mode	[SM]	Remote	
For ANSI-specified modes:			<ESC> [<Ps> ; ... ; <Ps> h
For DEC-private modes:			<ESC> [? <Ps> ; ... ; <Ps> h
For Fluke-private modes:			<ESC> [> <Ps> ; ... ; <Ps> h
Setup Screen Commands (Section 4)			
Setup Lockout Mode	{FSULM}	Remote	<ESC> [> 5 l (to reset)
			<ESC> [> 5 h (to set)
Save Setup	{FSSU}	Local/Remote	<ESC> [1 z
Recall Setup	{FRSU}	Local/Remote	<ESC> [2 z
Reset	[RIS]	Local/Remote	<ESC> <Ps> c
Communication Commands (Section 4)			
Baud Rate		Local	
Data Bits		Local	
Parity Enable		Local	
Parity Sense		Local	
Stop Bits		Local	
Local/Remote Mode		Local	
Reporting Format	{FRF}	Remote	<ESC> [<P1> ; <P2> ; <P3> w
Clear User Inputs	{FCUI}	Remote	<ESC> [7 z
Character Displaying Commands (Section 5)			
Display Normal Characters		Remote	<characters>
Display Double-Width Line	(DECDWL)	Remote	<ESC> # 6
Display Double-Size Line	(DECDHL)	Remote	<ESC> # 3 (top half)
			<ESC> # 4 (bottom half)
Display Normal Line	(DECSWL)	Remote	<ESC> # 5
Erase Character	[ECH]	Remote	<ESC> [<Pn> X
Erase in Line	[EL]	Remote	<ESC> [<Ps> K
Erase in Display	[ED]	Remote	<ESC> [<Ps> J
Character Interpretation Commands (Section 5)			
Auto Wrap-Around Mode	(DECAWM)	Local/Remote	<ESC> [? 7 l (to reset)
			<ESC> [? 7 h (to set)
Send-Receive Mode	[SRM]	Local/Remote	<ESC> [1 2 l (to reset)
			<ESC> [1 2 h (to set)
New Line Mode	[LNM]	Local/Remote	<ESC> [2 0 l (to reset)
			<ESC> [2 0 h (to set)
Select Character Set	[SCS]	Remote	<SO> (to select extended set)
			<SI> (to select standard set)
NOCHANGE Attribute Mode	{FNCAM}	Remote	<ESC> [> 3 l (to reset)
			<ESC> [> 3 h (to set)

Table D-3. Summary of Touch Control Screen Commands (cont)

COMMAND	MNEMONIC	SOURCE	HOST USAGE
National Replacement Code	{FNRC}	Local/Remote	<ESC> [4 ; <Ps> z
Set Character Attributes	[SGR]	Remote	<ESC> [<Ps> ; ... ; <Ps> m
Scrolling Region	(DECSTBM)	Remote	<ESC> [<Pt> ; <Pb> r
Origin Mode	(DECOM)	Remote	<ESC> [? 6 l (to reset)
			<ESC> [? 6 h (to set)
Cursor Commands (Section 5)			
Move Cursor to Absolute Position	[CUP]	Remote	<ESC> [<Pl> ; <Pc> H
Move Cursor Forward	[CUF]	Remote	<ESC> [<Pn> C
Move Cursor Backward	[CUB]	Remote	<ESC> [<Pn> D
Move Cursor Up	[CUU]	Remote	<ESC> [<Pn> A
Move Cursor Down	[CUD]	Remote	<ESC> [<Pn> B
Next Line	[NEL]	Remote	<ESC> E
Index	[IND]	Remote	<ESC> D
Reverse Index	[RI]	Remote	<ESC> M
Read Cursor Position	[CPR]	Remote	<ESC> [6 n
Read Character Under Cursor	{FRCUC}	Remote	<ESC> [> 3 n
Read Attributes Under Cursor	{FRAUC}	Remote	<ESC> [> 4 n
Cursor Type	{FCT}	Local/Remote	<ESC> [<Ps> ; ... ; <Ps> v
Screen Appearance Commands (Section 5)			
Screen Background Mode	(DECSCNM)	Local/Remote	<ESC> [? 5 l (normal)
			<ESC> [? 5 h (reverse)
Display Activity	{FDA}	Local/Remote	<ESC> [3 ; <Ps> z
Horizontal Alignment	{FHA}	Local/Remote	<ESC> [6 ; <Ps> z
Vertical Alignment	{FVA}	Local/Remote	<ESC> [5 ; <Ps> z
Vertical Refresh Rate		Local	
Region Commands (Section 6)			
Erase a Region	{FER}	Remote	<ESC> [8 ; <Pl> ; <Pc> ; <Pv> t
Outline a Region	{FOR}	Remote	<ESC> [6 ; <Pl> ; <Pc> ; <Pb> t
Modify Character Attributes in a Region	{FMCAIR}	Remote	<ESC> [7 ; <Pl> ; <Pc> ; <Pv> t
Touch Panel Commands (Section 6)			
Polled Touch Mode	{FPTM}	Remote	<ESC> [> 1 l (to reset)
			<ESC> [> 1 h (to set)
Read Touch Cell Status	{FRTS}	Remote	<ESC> [> 2 n
Auto-Repeat Rate	{FARR}	Remote	<ESC> [2 ; <Pn> u
Touch Cell Audible Attribute	{FTAA}	Remote	<ESC> [1 ; <Ps> u
Touch Panel Lockout Mode	{FTPLM}	Remote	<ESC> [> 2 l (to reset)
			<ESC> [> 2 h (to set)
Keyboard Commands (Section 7)			
Keyboard Lockout Mode	[KAM]	Remote	<ESC> [2 l (to reset)
			<ESC> [2 h (to set)
Keypad Mode	(DECKPAM)	Remote	<ESC> = (for Application Mode)
	(DECKPNM)	Remote	<ESC> > (for Numeric Mode)

Table D-3. Summary of Touch Control Screen Commands (cont)

COMMAND	MNEMONIC	SOURCE	HOST USAGE
(see Section 4)			
Send Long Break		Local	
Send Short Break		Local	
Local/Remote Mode		Local	
Status Reporting Commands (Section 8)			
Power-Up Interrupt Mode	{FPUIM}	Remote	<ESC> [> 4 l (to reset) <ESC> [> 4 h (to set)
Request Power Status	{FRPS}	Remote	<ESC> [> 0 n
Request TCS Identification	[DA]	Remote	<ESC> [c OR <ESC> [0 c
Request TCS Status	[DSR]	Remote	<ESC> [5 n
Self-Test Commands (Section 8)			
Continuous Integrity Test	{FCIT}	Local/Remote	<ESC> [2 ; 9 ; <Ps> y
Request ROM Test Report	{FRRTR}	Remote	<ESC> [> 6 n
Request Non-Volatile Memory Test Report	{FRETR}	Remote	<ESC> [> 7 n
Request RAM Test Report	{FRRATR}	Remote	<ESC> [> 8 n
Request Touch Panel Test Report	{FRTTR}	Remote	<ESC> [> 9 n

NOTES:

- Mnemonics in square brackets [ ] are ANSI-specified commands.
- Mnemonics in braces { } are ANSI-compatible, Fluke-private commands.
- Mnemonics in parentheses ( ) are ANSI-compatible, DEC®-private commands. (DEC is a registered trademark of Digital Equipment Corporation.)
- Optional parameters are represented in angle brackets (e.g., <Ps>).

Appendix E

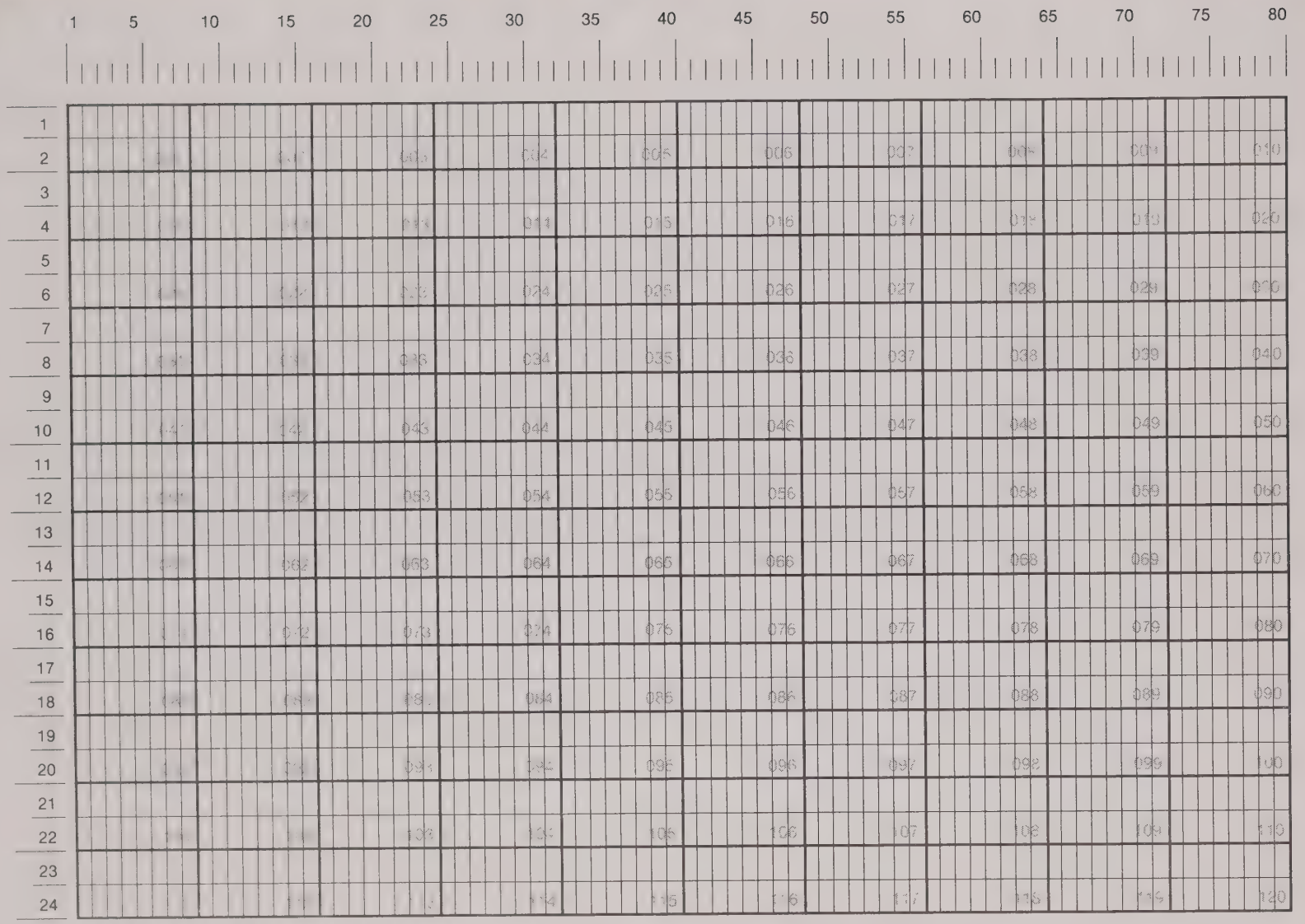
Touchkey Programming Worksheets

Notes: _____

_____

Program Title _____ Programmer _____ Page _____ of _____

FLUKE®

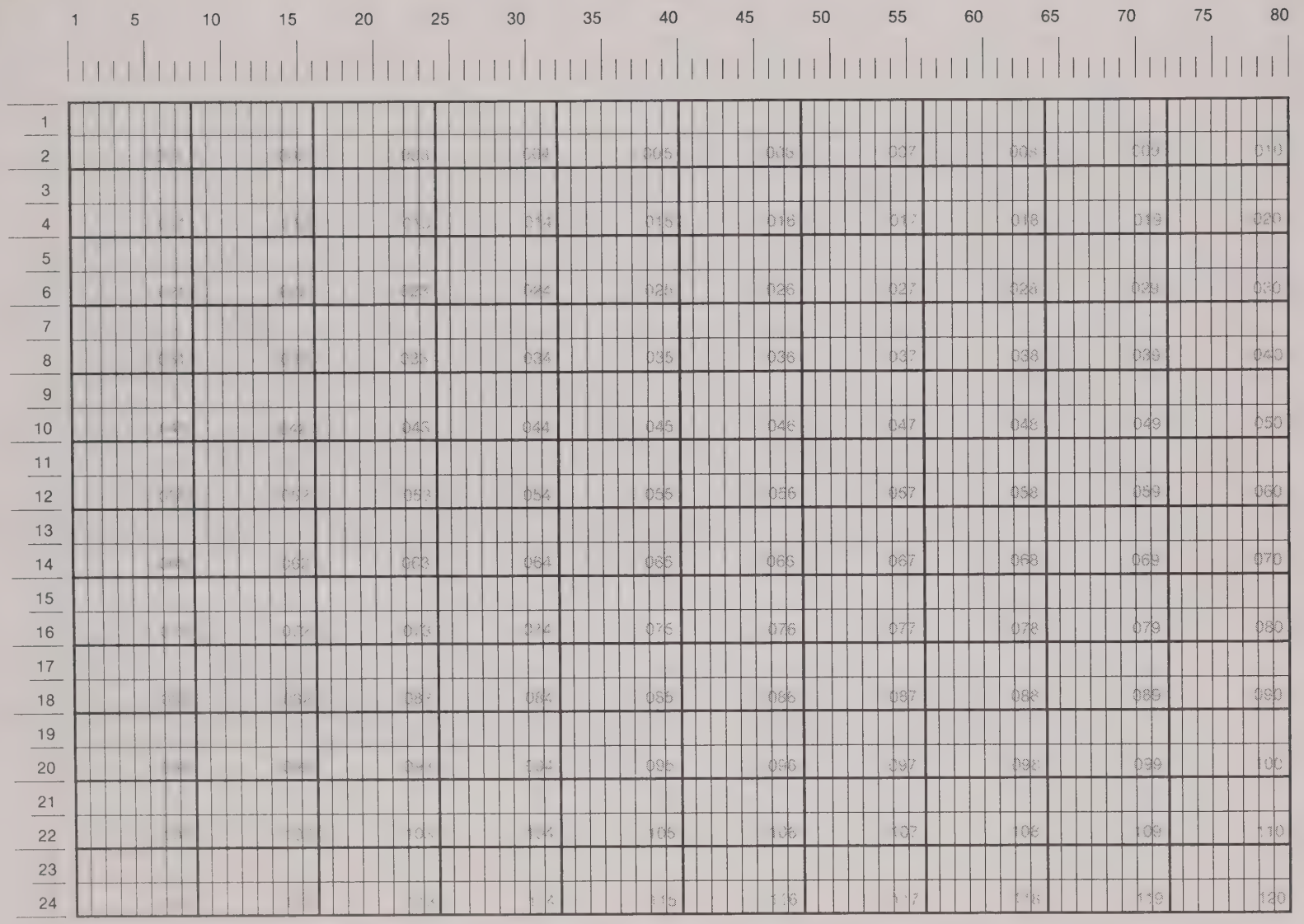


Notes: _____

_____

Program Title _____ Programmer _____ Page ____ of ____

FLUKE®

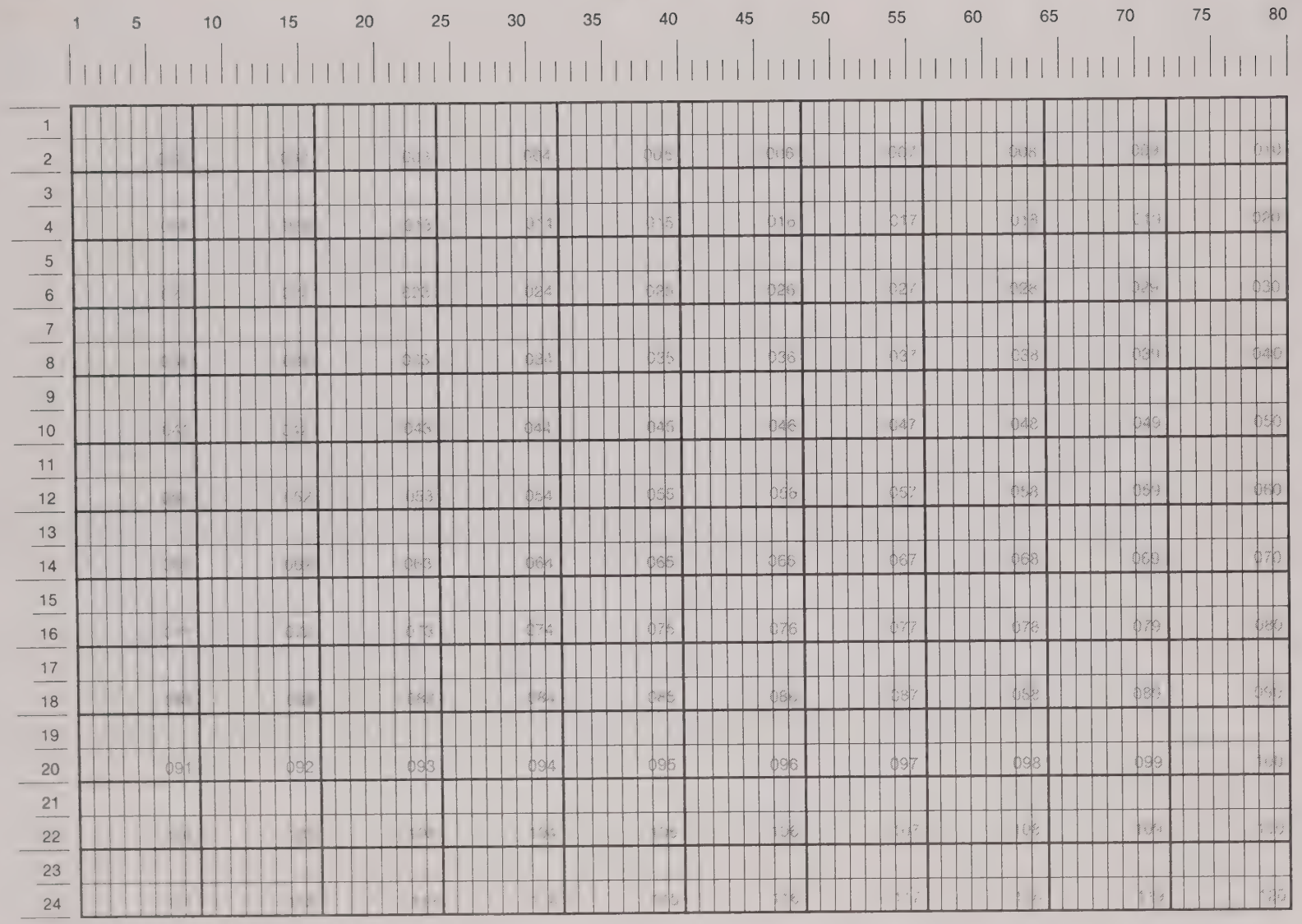


Notes: _____

_____

Program Title _____ Programmer _____ Page ____ of ____

FLUKE®

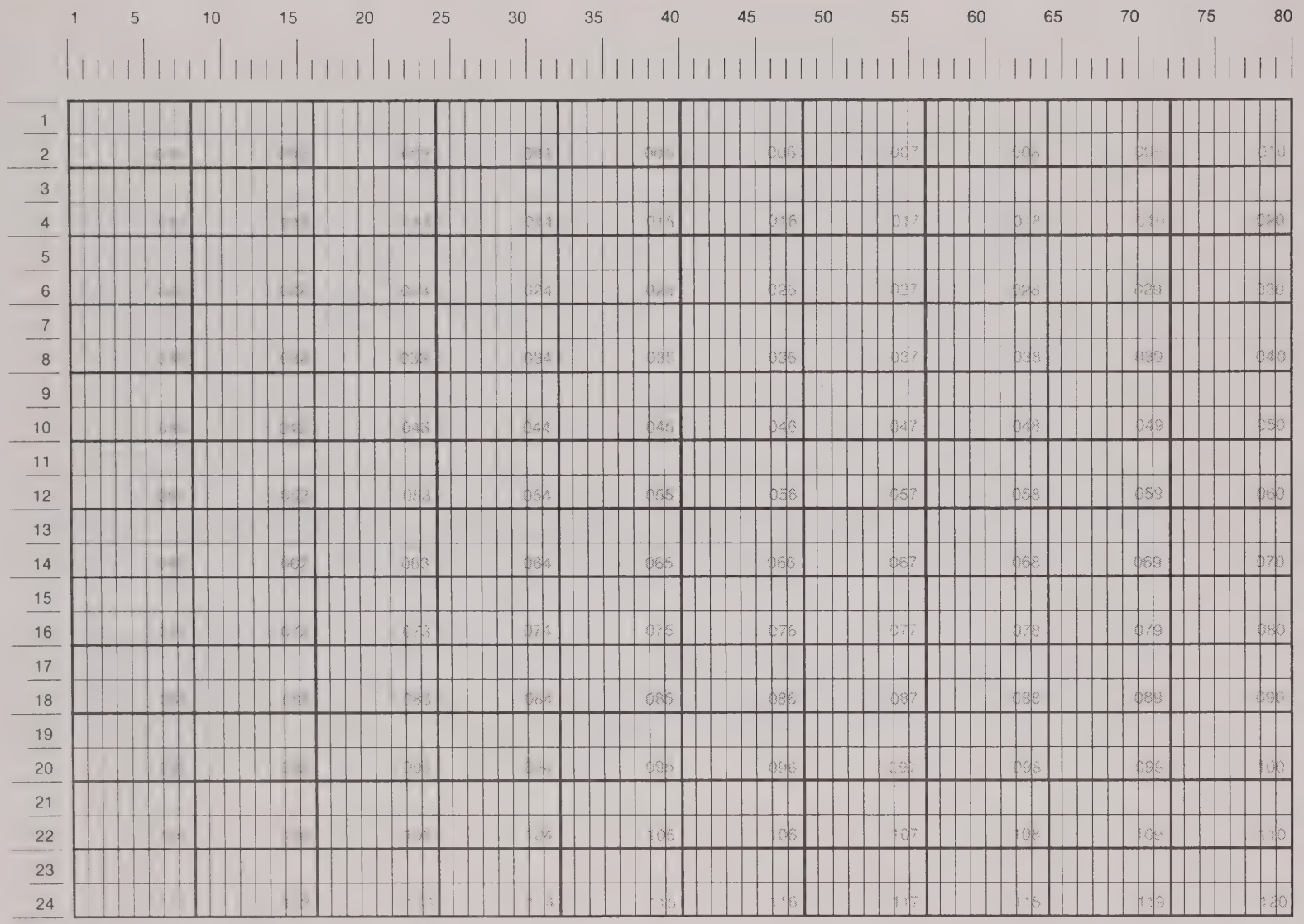


Notes: _____

_____

Program Title _____ Programmer _____ Page _____ of _____

FLUKE



Notes: _____

_____

Program Title _____ Programmer _____ Page _____ of _____

FLUKE®

Index

NOTE

To locate the detailed description of a specific command by name, mnemonic, or function, see the command lookup tables in Appendix D.

ANSI control strings, see control strings
ANSI standard X3.64-1979, **3-1**
Auto Wrap-Around Mode command, **5-15**
Auto-Repeat Rate command, **6-16**

Backspace <BS>, **3-3**
Baud Rate command, **4-15**
Bell <BEL>, **3-3**
Boxtypes, **3-4, 6-8**
Break key, **7-2**

Cancel <CAN>, **3-3**
Carriage return <CR>, **3-3**
Character composition, **2-2**
Character displaying commands, **5-3**
  Display Double-Size Line command, **5-7**
  Display Double-Width Line command, **5-6**
  Display Normal Line command, **5-8**
  Displaying normal characters, **5-4**
  Erase Character command, **5-9**
  Erase in Display command, **5-12**
  Erase in Line command, **5-10**
Character interpretation commands, **5-14**
  Auto Wrap-Around Mode command, **5-15**
  National Replacement Code command, **5-23**
  New Line Mode command, **5-17**
  NOCHANGE Attribute Mode command, **5-20**
  Origin Mode command, **5-32**
  Scrolling Region command, **5-30**
  Select Character Set command, **5-18**
  Send-Receive Mode command, **5-16**
  Set Character Attributes command, **5-28**
Character sets, **3-2, Appendix B**
Clear User Inputs command, **4-23**
Command lookup tables, **Appendix D**
Commands, types, **3-4**
  Local commands, **3-4**
  Local/Remote commands, **3-8**
  Remote commands, **3-7**
Communication commands, **4-14**
  Baud Rate command, **4-15**
  Clear User Inputs command, **4-23**
  Data Bits command, **4-16**
  Parity Enable command, **4-17**
  Parity Sense command, **4-18**
  Reporting Format command, **4-21**
  Stop Bits command, **4-19**
Communication errors, **2-8**
  Character overflow control, **2-9**
  Types of, **2-8**
Communication standards, use of, **2-4**
  When should RS-422-A be used?, **2-8**
  RS-232-C, **2-5**
  RS-232-C connector, **2-6**
  RS-232-C signal descriptions, **2-6**
  RS-422-A, **2-8**
Control characters, **3-3**
Control sequences, **3-9**
Control strings, **3-8**
  Composition of a control string, **3-8**
  Control string summary, **3-5**
  How the TCS interprets control sequences, **3-12**
  Local versus remote, **3-4, 3-7**
Cursor commands, **5-34**
  Cursor Type command, **5-49**
  Index command, **5-42**
  Move Cursor Backward command, **5-38**
  Move Cursor Down command, **5-40**
  Move Cursor Forward command, **5-37**
  Move Cursor to Absolute Position command, **5-35**
  Move Cursor Up command, **5-39**
  Next Line command, **5-41**
  Read Attributes Under Cursor command, **5-47**
  Read Character Under Cursor command, **5-45**
  Read Cursor Position command, **5-44**
  Reverse Index command, **5-43**

Data Bits command, 4-16
Data rate, 2-2
Display Activity command, 5-53
Display Double-Size Line command, 5-7
Display Double-Width Line command, 5-6
Display Normal Line command, 5-8
Displaying normal characters, 5-4

Erase Character command, 5-9
Erase a Region command, 6-6
Erase in Display command, 5-12
Erase in Line command, 5-10
Escape <ESC>, 3-3, 3-9
Extended character set, 3-3, 5-2, **Appendix B**
  Boxtypes, 5-2, 6-8
  International characters, 5-2, 5-23

Features, 1-1
Form Feed <FF>, 3-3
Functional overview of the TCS, 1-6
  Data flow from the host to the TCS, 1-6
  Data flow from the TCS to the host, 1-6
  Non-Volatile setup memory, 1-6
Functional volatility, overview of , 4-2

Horizontal alignment, 5-55
Horizontal Tab <HT>, 3-3

Index command, 5-42
International characters, 5-23
Introduction, 1-1

Keyboard
  Auxiliary keypad, 7-7
  Cursor control keys, 7-4
  Description, 7-1
  Set Up key, 7-4
  Special function keys, 7-6
  Standard keys, 7-2
Keyboard commands, 7-8
  Keyboard Lockout Mode command, 7-9
  Keypad Mode command, 7-10
  Local/Remote Mode command, 4-20
  Send Long Break command, 7-12
  Send Short Break command, 7-13
Keyboard Lockout Mode command, 7-9
Keypad Mode command, 7-10

Line Feed <LF>, 3-3
Local commands, 3-4
Local Echo, **see** Send-Receive Mode command
Local/Remote Mode command, 4-20
Long break, 7-12

Modes, 3-16
  Summary, 3-16
  TCS Mode commands, 3-18
Modify Character Attributes in a Region command, 6-11
Move Cursor Backward command, 5-38
Move Cursor Down command, 5-40
Move Cursor Forward command, 5-37
Move Cursor to Absolute Position command, 5-35
Move Cursor Up command, 5-39

National Replacement Code command, 5-23
New Line Mode command, 5-17
Next Line command, 5-41
NOCHANGE attribute mode, 5-20

Organization of the guide, 1-4
Origin Mode command, 5-32
Outline a Region command, 6-8

Parity Enable command, 4-17
Parity Sense command, 4-18
Polled Touch Mode command, 6-14
Power-Up Interrupt Mode command, 8-3
Preventing and catching errors, 2-9
  Character overflow control, 2-9
  Types of communication errors, 2-8

Read Attributes Under Cursor command, 5-47
Read Character Under Cursor command, 5-45
Read Cursor Position command, 5-44
Read Touch Cell Status command, 6-15
Recall Setup command, 4-11
Region commands, 6-5
  Erase a Region command, 6-6
  Modify Character Attributes in a Region command, 6-11
  Outline a Region command, 6-8
Remote commands, 3-7
Remote self-testing, 8-1
Reporting Format command, 4-21
Request Non-Volatile Memory Test Report command, 8-12
Request Power Status command, 8-4
Request RAM Test Report command, 8-13
Request ROM Test Report command, 8-11
Request TCS Identification command, 8-5
Request TCS Status command, 8-6
Request Touch Panel Test Report, 8-15
Reset command, 4-12
Reset Mode command, 3-19
Reverse Index command, 5-43
RS-232-C, 2-5
  RS-232-C connector, 2-6
  RS-232-C signal descriptions, 2-6, **Appendix C**

RS-422-A, 2-8
RS-422-A signal descriptions, 2-8, **Appendix C**
When should RS-422-A be used?, 2-8

Sample Touch Panel programs, 9-1
Save Setup command, 4-10
Screen appearance commands, 5-51
Display Activity command, 4-4, 5-53
Horizontal Alignment command, 5-55
Screen Background Mode command, 5-52
Vertical Alignment command, 5-56
Vertical Refresh Rate command, 5-57
Screen Background Mode command, 5-52
Scrolling Region command, 5-30
Select Character Set command, 5-18
Send Long Break command, 7-12
Send-Receive Mode command , 5-16
Send Short Break command, 7-13
Serial data, 2-1
Character composition, 2-2
Data rate, 2-2
Timing format, 2-2
Set Character Attributes command, 5-28
Set Mode command, 3-20
Setting communication parameters, 2-11
Setup Lockout Mode command, 4-9
Setup Screen commands, 4-8
Recall Setup command, 4-11
Reset command, 4-12
Save Setup command, 4-10
Setup Lockout Mode command, 4-9
Setup Screen programming considerations, 4-4
Display activity, 4-4
Display contents, 4-4
Host communication while in setup, 4-5
Keyboard lockout, 4-4
Overview of functional volatility, 4-2
Permanence of changes to operating parameters, 4-6
Touch panel lockout, 4-4
User/Host conflict resolution, 4-6
Shift In <SI>, 3-3
Shift Out <SO>, 3-3
Standard character set, 3-2, 5-2, **Appendix B**

Standards, communication, use of, 2-4
RS-232-C, 2-5
RS-232-C signal descriptions, 2-6
RS-422-A, 2-8
When should RS-422-A be used?, 2-8
Status reporting commands, 8-2
Power-Up Interrupt Mode command, 8-3
Request Power Status command, 8-4
Request TCS Identification command, 8-5
Request TCS Status command, 8-6
Status reports, summary of, 3-13
Stop Bits command, 4-19
Substitution <SUB>, 3-3

Tests, remote self-test, 8-1
TCS Mode commands, 3-18
Reset Mode command, 3-19
Set Mode command, 3-20
Timing format, 2-2
Touch Cell Audible Attribute command, 6-18
Touch cells, 6-1
Touch Panel commands, 6-13
Auto-Repeat Rate command, 6-16
Polled Touch Mode command, 6-14
Read Touch Cell Status command, 6-15
Touch Cell Audible Attribute command, 6-18
Touch Panel Lockout Mode command, 6-20
Touch panel, 6-1
Touch Panel Lockout Mode command, 6-20
Touch reporting, 6-3
Touchkeys, 6-2
Touch targets 6-2

Vertical Alignment command, 5-56
Vertical Refresh Rate command, 5-57
Vertical Tab <VT>, 3-3
Volatility, see functional volatility

XOFF, 2-10
XOFF <DC3>, 3-3
XON, 2-10
XON <DC1>, 3-3

1020 Series

TOUCH CONTROL SCREEN

Designer's Guide

FLUKE

1020 Series

TOUCH CONTROL SCREEN

Designer's Guide

P/N 778761
APRIL 1986 Rev. 1, 7/89
© 1989, John Fluke Mfg. Co., Inc. All rights reserved. Litho in U.S.A.

FLUKE

Table of Contents

SECTION	TITLE	PAGE
1	**INTRODUCTION**	**1-1**
	Introduction	1-1
	Features	1-1
	About the Designer's Guide	1-3
	Ordering Information	1-4
2	**SPECIFICATIONS**	**2-1**
	Introduction	2-1
3	**ELECTRICAL DESIGN**	**3-1**
	Introduction	3-1
	Power Line Connections	3-1
	The RS-232-C Connector	3-1
	RS-232-C Interface Pin Assignment	3-2
	RS-232-C Signal Descriptions	3-2
	Balanced Transmit and Receive Data (RS-422-A)	3-5
	Recommended Cabling	3-5
	RS-422-A Resistive Termination	3-7
	Host Communication Considerations	3-8
	Baud Rate	3-8
	Host Interface Buffering Limitations	3-8
	Host Interface XON/XOFF Control	3-9
	User Interface Control	3-10
	Dip Switch and Jumper Definitions	3-11
	The Custom Connectors	3-11
	Pin Definitions	3-11
	Cabling	3-12
	Shielding	3-13
	How to Use the Custom Connector and the Custom Video Connector	3-13
4	**MECHANICAL DESIGN**	**4-1**
	Introduction	4-1
	Panel Mounting Considerations	4-2

(continued on page ii)

SECTION	TITLE	PAGE
	Panel Mounting the TCS	4-4
	Rack Mounting the TCS	4-4
	Surface Mounting	4-4
	Using The Fluke Tilt/Swivel Base Assembly	4-4
	Mounting Configurations Without The Fluke Tilt/Swivel Base Assembly	4-6
	Environmental Considerations	4-7
	Temperature	4-7
	Resistance To Contamination	4-8
	Shock And Vibration	4-8
	Detailed Specification Information	4-8
5	**DESIGNING FOR SAFETY**	**5-1**
	Introduction	5-1
	Methods	5-1
	Service and Maintenance	5-2
	Integrity Verification	5-2
	Other References	5-2
	APPENDICES	
A	Custom Character Sets	A-1
B	Raw Keyboard Codes and Keyboard Interface	B-1
C	Glossary	C-1
	INDEX	

List of Tables

TABLE	TITLE	PAGE
1-1.	Touch Control Screen Ordering Information	1-4
2-1.	Touch Control Screen Specifications	2-1
3-1.	RS-232-C Interface Connector Pin Assignments	3-3
3-2.	Jumper Settings	3-11
3-3.	Custom Connector Pin Definitions	3-12
3-4.	Custom Video Connector Pin Definitions	3-12
3-5.	Required Supply Voltage and Current Specifications	3-16
A-1.	Standard Character Set	A-2
A-2.	Extended Character Set	A-3
A-3.	Character Set Description	A-4
A-4.	Boxtype EPROM Locations	A-5
B-1.	Raw Keyboard Codes	B-2
B-2.	Raw Keypad Codes	B-3

List of Illustrations

FIGURE	TITLE	PAGE
2-1.	External Dimensions	2-4
3-1.	Minimum RS-232-C Cable Configuration	3-6
3-2.	Y1062 RS-232-C Null-Modem Cable Wiring Diagram	3-6
3-3.	Y1707 and Y1708 RS-232-C Accessory Cable Wiring Diagram	3-7
3-4.	RS-422-A Cable Configuration	3-7
3-5.	Configuration DIP Switch Accessible through the Chassis Bottom	3-8
3-6.	Character Font EPROM and Jumper Locations	3-14
3-7.	External Beeper Connection	3-15
3-8.	External Setup Switch Connection	3-15
3-9.	External Power Input and External Power Output	3-15
3-10	External Keyboard Connection	3-16
3-11	External Contrast Connection	3-17
3-12	Composite Video Connection	3-17
3-13	AC Line Lock Connection	3-18
3-14	External Reset Connection	3-19
4-1.	The 1021 TCS	4-1
4-2.	The TCS With Optional Enclosure and Tilt/Swivel Base	4-2
4-3.	Panel Mounting Dimensions	4-3
4-4.	Installing the TCS	4-5
4-5.	Installing the Clips	4-5
4-6.	Mounting Assembly With the Optional Enclosure	4-6
4-7.	Mounting Assembly Without the Optional Enclosure	4-7
A-1.	Encoding the Letter H	A-6
A-2.	Display Character Addressing	A-6
A-3.	Opening the TCS Chassis	A-9

Section 1
Introduction

INTRODUCTION

The Touch Control Screen (TCS) is a sophisticated interface between human operators and computer-driven systems. The TCS allows the operator, with a minimum of training, to accurately and efficiently control even the most complex operations, simply by touching the screen.

The Touch Control Screen interprets character strings from the host computer to create displays that provide the operator with information, or ask the operator to select from the choices presented. The operator responds naturally by pointing to the appropriate choice and touching the display lightly. The TCS, acting as a software configured control panel, tells the computer that a particular area was touched.

The TCS is easy to integrate into any computer-based system, and is packaged to be easily mounted into a panel, in a rack, or on a table top. High-level software support facilitates the design of "touch targets" using only a few simple commands. The extreme reliability and durability of the TCS makes it appropriate for use in a variety of rugged environments.

FEATURES

The features of the TCS include:

- Touch panel consisting of a matrix of 120 touch cells (12 rows of 10 touch cells each).
- High-contrast CRT capable of displaying 1920 characters (24 lines of 80 characters each).
- User-selectable line attributes. Examples include normal, double width, and double size.
- User-selectable character attributes. Examples include highlight, underline, blink, and reverse video.
- Direct cursor addressing.
- Region commands that allow the programmer to outline and modify attributes within a rectangular region of the display.

- Programmable cursor type. Examples include a reverse block that is non-blinking, slow-blinking, or fast-blinking; an underline that is non-blinking, slow-blinking, or fast-blinking; and an invisible cursor.
- Large character set (256 characters).
- National Replacement Code method for the display of international characters.
- RS-232-C serial interface port with selectable baud rates in standard increments up to 19,200 baud.
- RS-422-A serial interface port for higher signalling rates at distances up to 1200 meters (4000 feet).
- Rack mount and panel mount capability.
- NEMA 12 (National Electrical Manufacturers Association) water and dust resistance capability when panel mounted. (Requires the optional NEMA 12 Panel Mounting Kit.)
- Non-volatile memory to store Setup parameters while the power is off.
- High-level software support of touch control, including box drawing commands.
- Extensive built-in remote testability and status reporting.
- Simultaneous display of touchkeys and scrolling data.
- Test Screen for user-selected testing of the electronics, the display, and the touch panel.
- Alignment Screen for ensuring proper alignment between the display and the touch panel.
- Optional enclosure and tilt/swivel base.
- Optional detachable keyboard.
- Custom Connector that provides access to selected internal signals on the logic board.
- Wide operating temperature range.
- Optional fan for increased temperature range.
- Designed to comply with IEC 348, IEC 435, ANSI/UL 448, and CSA 556B safety standards.
- Verified to comply with FCC Class B and VDE 0871B EMI regulations.
- High resistance to shock and vibration.

ABOUT THE DESIGNER'S GUIDE

The Designer's Guide explains how to incorporate the Touch Control Screen into a custom-designed system. The sections contain the following information:

Section 1 Introduction

Section 1 presents an overview of the TCS functions, the organization of the Designer's Guide, and ordering information for options and accessories.

Section 2 Specifications

Section 2 lists electrical, mechanical, and environmental specifications for the TCS. This section also covers the standards and safety specifications that the TCS is designed to meet.

Section 3 Electrical Design

Section 3 contains material for design engineers concerned with electrical and data communication design. Contents include a detailed description of the serial port and a discussion of the various speed considerations related to communication between the TCS and the host. This section also includes information on the Custom Connector.

Section 4 Mechanical Design

Section 4 provides hardware engineers with a description of the mechanical design details and mounting information. This section covers panel mounting considerations, rack mounting approaches, table-top mounting capabilities, and environmental considerations.

Section 5 Designing for Safety

Section 5 presents some considerations for designing a safe touch control based operator interface. Information in this section identifies useful safety devices and techniques, and helps the designer determine which are appropriate for a particular control interface system.

The appendices include:

Appendix A Custom Character Sets

Appendix A explains how to design custom character sets for the TCS. This appendix describes the standard and extended character sets, explains special characters and control characters, discusses how ASCII characters are decoded and displayed, and shows how to program custom character sets. Five copies of the custom character worksheet are included.

Appendix B Raw Keyboard Codes and Keyboard Interface

Appendix B contains the raw codes and keyboard interface information for the TCS keyboard.

Appendix C Glossary

Appendix C provides a glossary of the technical terms and nomenclature used in this guide.

It is recommended that the designer read the User's Guide before the Designer's Guide. The User's Guide provides basic information about the TCS, including information about the Setup and Test Screens.

ORDERING INFORMATION

A wide variety of options and accessories is available to configure the basic TCS to the needs of the system designer. Other TCS models are also available. For complete information about TCS models and accessories, refer the Fluke catalog.

NOTE

The list of options and accessories is complete at this printing. However, due to Fluke's ongoing program of hardware and software development, other options or accessories may become available. Contact your local Fluke representative for the latest information.

Table 1-1. Touch Control Screen Ordering Information

MODEL	DESCRIPTION
1021	Touch Control Screen; includes panel mount clips, line cord, and Inspection and Installation Guide. Options and accessories available separately.
OPTION	**DESCRIPTION**
1021-10	Amber Phosphor Display (factory configured)
1021-20	Fan (with cover, filter)
1021-30	Enclosure
1021-31	Tilt/Swivel Base (used on 1021-30)
1021-60	Custom Connector Extender Cable (factory configured)
1021-90	1020 Series Manual Set
102X-902	TCS Toolbox Software (for use with Microsoft QuickBASIC)
ACCESSORY	**DESCRIPTION**
Y1000	Alphanumeric Keyboard
Y1062	TCS Null-Modem Cable
Y1070*	NEMA 12 Panel Mounting Kit
Y1080*	19-inch Rack Mount Kit
Y1081*	19-inch Rack Mount Kit with 18-inch slides
Y1082*	19-inch Rack Mount Kit with 24-inch slides
Y1085	Keyboard Extender Cable (used on Y1080, Y1081, Y1082)
Y1090	Contrast Enhancement Overlay

* Do not order 1021-30 when using this accessory.

Section 2
Specifications

INTRODUCTION

This section lists the Touch Control Screen (TCS) specifications and the standards to which the TCS complies. Specifications for the 1021 Touch Control Screen are shown in Table 2-1. Outline drawings of the Touch Control Screen are shown in Figure 2-1.

Table 2-1. Touch Control Screen Specifications

ENVIRONMENTAL	
Temperature	
Operating	0 to 50°C without plastic enclosure. 0 to 60°C without plastic enclosure, with optional fan. 0 to 40°C with plastic enclosure. 0 to 50°C with plastic enclosure, with optional fan.
Nonoperating	-40 to 75°C.
Relative Humidity	
0 to 30°C	95% (Noncondensing).
30 to 40°C	75% (Noncondensing).
40 to 55°C	45% (Noncondensing).
55 to 75°C	40% (Noncondensing).
Altitude	
Operating	3,050 meters (10,000 ft).
Nonoperating	12,000 meters (40,000 ft).
Power	
NOTE This is an IEC safety class 1 product. The ground wire in the line cord must be connected for safety.	
Voltage	90 to 132V ac, 47 to 440 Hz; 180 to 264V ac, 47 to 440 Hz.
Safety Ground Leakage Current	Less than 0.5 mA at 47 to 63 Hz. Less than 3.5 mA at 63 to 440 Hz.
Power Consumption	Less than 50 watts. Less than 1A rms at 90 to 132V ac. Less than 0.5A rms at 180 to 264V ac.

Table 2-1. Touch Control Screen Specifications (cont)

Vibration ..... Meets the requirements of MIL-T-28800C, class 3.

FREQUENCY	FORCE	DOUBLE AMPLITUDE
5-15 Hz	0.7G at 15 Hz	1.52 mm (0.06 inch)
15-25 Hz	1.3G at 25 Hz	1.02 mm (0.04 inch)
25-55 Hz	3G at 55 Hz	0.51 mm (0.02 inch)

Shock ..... 1/2 sine shock of 30G for 11 ms ±1 ms.

Dust-tight and Drip-tight ..... Suitable for use in NEMA Type 12 enclosure with optional NEMA 12 Panel Mounting Kit.

PACKAGING

Dimensions ..... 335.3 mm (13.2 in) wide;
260.9 mm (10.27 in) high;
318 mm (12.5 in) deep without enclosure;
330 mm (13.0 in) deep with enclosure.

Minimum Mounting Depth ..... 300 mm (11.8 in) from back of bezel to back of TCS, without cables.
381 mm (15.0 in) with Fluke cables.

Weight ..... 8.44 kg (18.6 lbs) without plastic enclosure.
Enclosure ..... 1.59 kg (3.5 lbs).
Tilt/Swivel Base ..... 0.68 kg (1.5 lbs).

Panel Mount ..... Three point mounting clips provided.
Rack Mount ..... 482.6 mm (19.0 in) wide.
265.9 mm (10.5 in) high, six rack units.
Tilt/Swivel Base ..... Forward tilt of up to 5 degrees.
Backward tilt of up to 15 degrees.

TOUCH PANEL

Type ..... Membrane switch matrix.
Number of Touch Cells ..... 12 rows, 10 columns, extending to the edge of the display.
Touch Cell Size ..... 2 rows, 8 columns of single size characters.
Resistance to Damage ..... Hardened scratch-resistant surface.
Light Transmissibility ..... Greater than 60 percent.
Optical Characteristics ..... Antiglare standard.

CRT

Tube Size ..... 305 mm (12 in), measured diagonally.
Tube Type ..... Monochrome P31 phosphor (green) standard.
Monochrome PC194 phosphor (amber) optional.

Table 2-1. Touch Control Screen Specifications (cont)

DISPLAY CHARACTERISTICS

Scanning Method	Non-interlaced raster.
Refresh	50/60 Hz, programmable, stored in non-volatile memory.
Active Display Size	203 mm (8 in) wide, 137 mm (5.4 in) high.
Character Cells on Screen	24 lines of 80 characters.
Dots per Character Cell	8 dots wide, 10 dots high.
Line Attributes	Normal, double width, double size.
Character Attributes	Normal, highlight, underline, blink, reverse video.
Character Set Size	256 characters (includes ASCII characters).
International Characters	Provided using National Replacement Code (NRC) method.
Display Alignment	Programmable; stored in non-volatile memory. Horizontal adjustment range: 12 characters, 1 character resolution. Vertical adjustment range: 2.4 characters, (24 scan lines), 0.1 character (1 scan line) resolution.
Display Geometry	Horizontal line fits within 2.54 mm (0.1 in) slot, vertical line fits within 1.25 mm (0.05 in) slot.

BEEPER

Frequency	2.1 kHz.
Loudness	Two levels and off, switch selectable.

KEYBOARD

Length	470.2 mm (18.51 in).
Width	211.5 mm (8.33 in).
Maximum Total Height	50.8 mm (2.0 in), includes keycaps.
Weight	1.59 kg (3.5 lb).

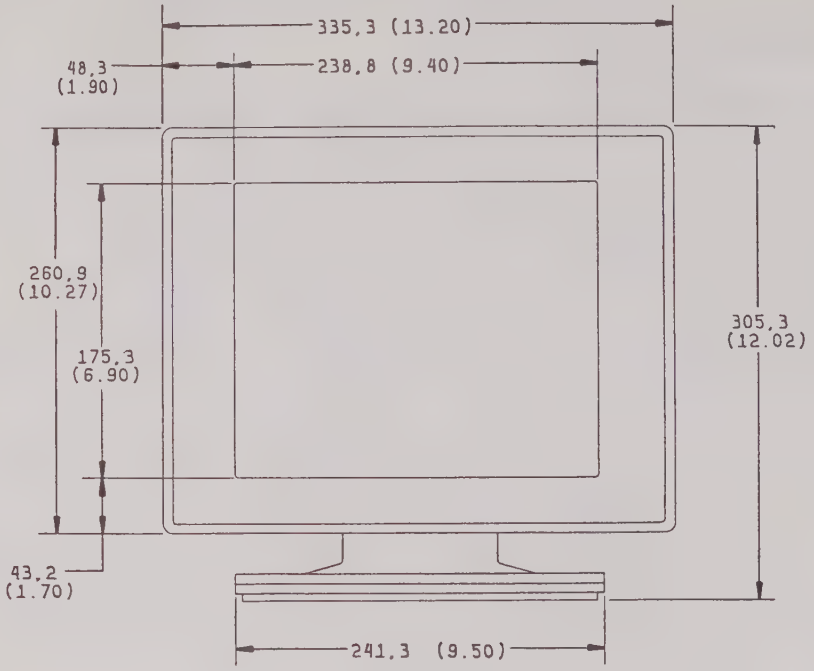
STANDARDS

The Touch Control Screen is designed to comply with the following safety standards:

ANSI/UL	478	Standard for Electronic Data Processing Units and Systems.
IEC	348	Safety Requirement for Electronic Measuring Apparatus.
IEC	435	Safety of Data Processing Equipment.
CSA	556B	Certification Requirements for Electronic Instruments and Scientific Apparatus.

The TCS has been verified to comply with the following EMI (electromagnetic interference) standards:

FCC	Part 15, subpart J	Computing Devices (class B).
VDE	0871	Radio Frequency Interference Suppression of Radio Frequency Equipment for Industrial, Scientific and Medical and Similar Purposes (class B).



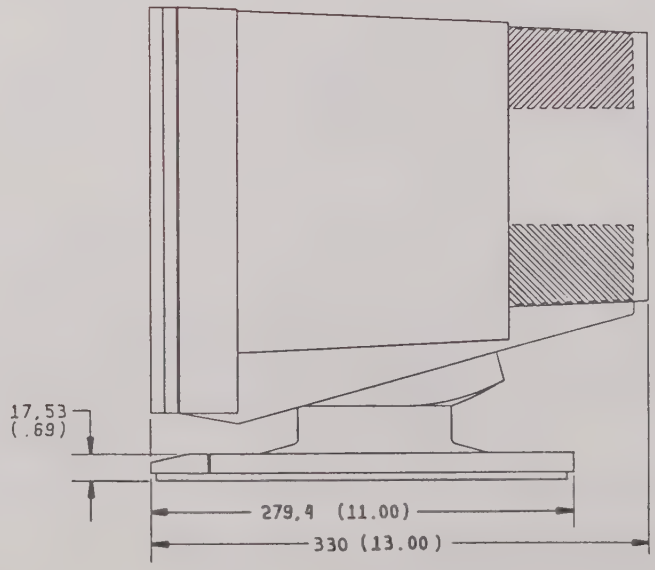


Figure 2-1. External Dimensions

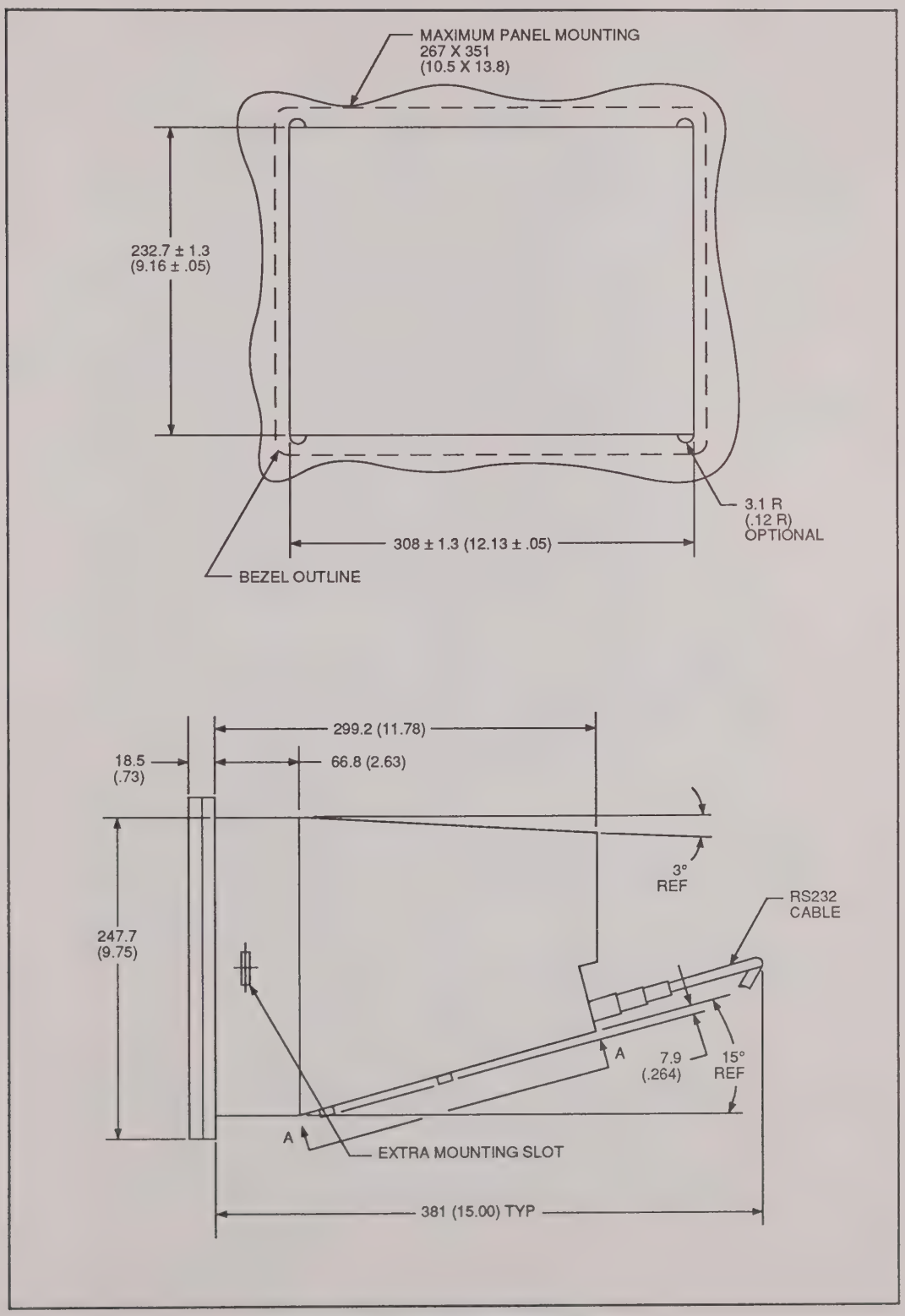


Figure 2-1. External Dimensions (cont)

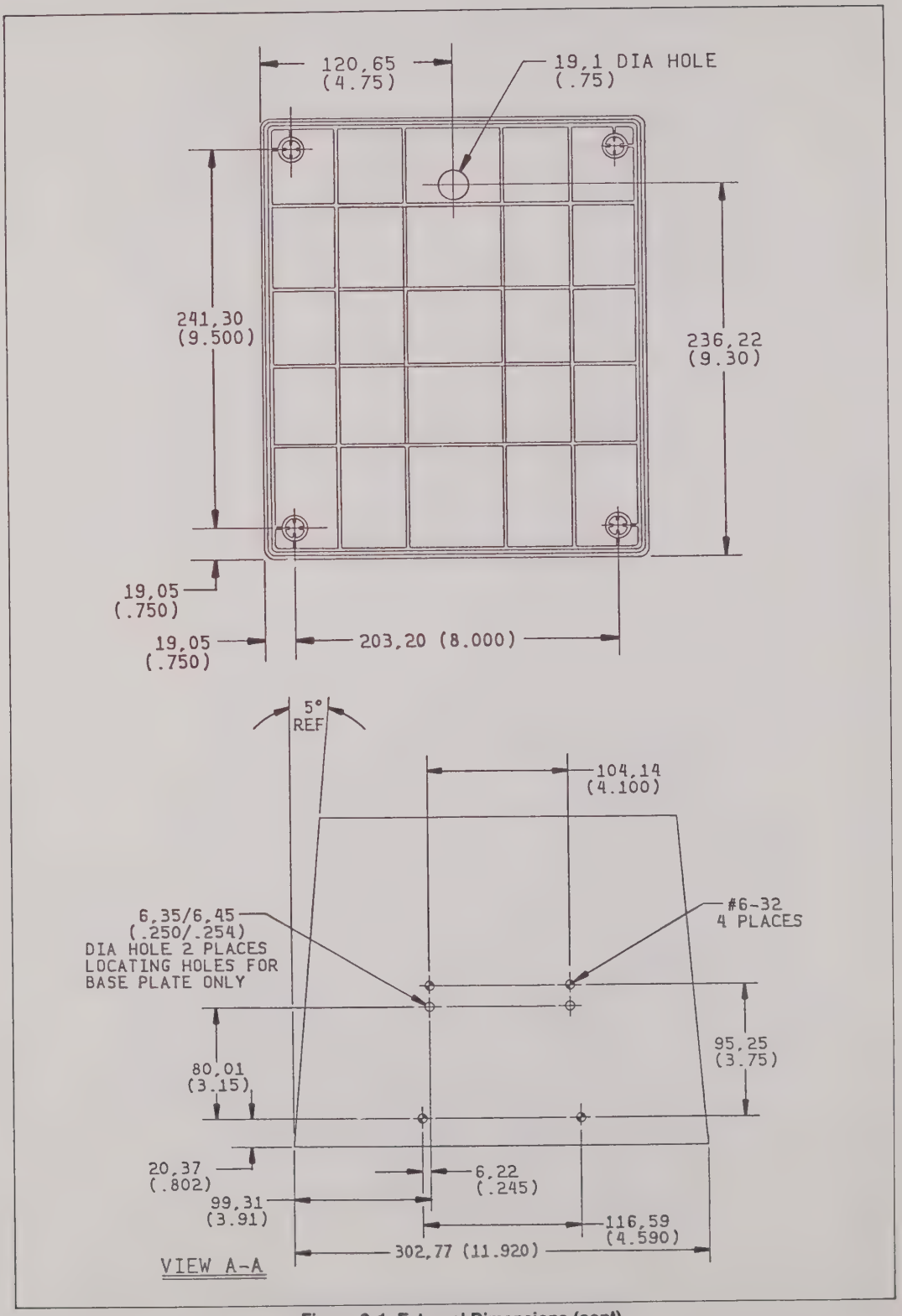


Figure 2-1. External Dimensions (cont)

Section 3
Electrical Design

INTRODUCTION

This section discusses electrical considerations of the Touch Control Screen (TCS). Topics include:

- Designing trouble-free electrical connections
- Designing a serial-data communication connection
- Designing external controls and displays

NOTE

The TCS has been designed to comply with the limits for a Class B computing device pursuant to Subpart J of Part 15 of FCC rules. To maintain this rating, the TCS must be properly grounded, and all data connections should be made with shielded cables.

POWER LINE CONNECTIONS

The TCS can be powered either by external ac power using a standard three-prong connector, or by dc power supplied through the Custom Connector.

AC power line requirements are as follows:

Voltage	90 to 132V ac, 47 Hz to 440 Hz; 180 to 264V ac, 47 Hz to 440 Hz.
Power Consumption	Less than 50 watts.

For information on powering the TCS using the Custom Connector, see the heading, How to Use the Custom Connector, later in this section.

The TCS is designed to withstand a broad range of power line disturbances, including power line noise, fades, and surges.

THE RS-232-C CONNECTOR

The TCS is DTE (Data Terminal Equipment) that provides an asynchronous serial interface port for communicating with other RS-232-C compatible equipment.

RS-232-C is a digital communications interface standard that defines electrical signal, mechanical, and functional characteristics.

Communications parameters on the serial port may be changed using the Setup Screen on the TCS. This process is described in detail in the User's Guide under the heading, Using the Setup Screen.

RS-232-C Interface Pin Assignment

The RS-232-C interface connection on the TCS is a 25-pin, D-series, male connector. Pin definitions and descriptions for this connector are listed in Table 3-1.

NOTE

Connector gender is determined by the individual pins and sockets, not by the connector housing.

RS-232-C Signal Descriptions

NOTE

The TCS is Data Terminal Equipment (DTE) as described by the RS-232-C standard. As a DTE unit, the TCS is connected to Data Communication Equipment (DCE), such as a modem. Connection to another DTE unit requires the use of a null-modem cable (shown in Figure 3-2).

The RS-232-C signals used by the TCS are described below. The RS-232-C signal designations are given in parenthesis after each signal name.

NOTE

When an RS-232-C control signal is on, its voltage is +3V to +25V. When the control signal is off, its voltage is -3V to -25V. When an RS-232-C data transmit and receive signal is in mark (one) condition, its voltage is -3V to -25V. When the data signal is in space (zero) condition, its voltage is +3V to +25V.

- Protective Ground (AA)

  Protective Ground is the common chassis ground of the TCS.

- Signal Ground (AB)

  Signal Ground is the common reference for the data and control lines.

- Transmitted Data (BA) (Output)

  Transmitted Data carries the stream of data bits generated by the TCS and sent to the DCE.

Table 3-1. RS-232-C Interface Connector Pin Assignment

PIN	CIRCUIT	I/O	DESCRIPTION
1	AA	—	Protective Ground
2	BA	OUT	Transmitted Data
3	BB	IN	Received Data
4	CA	OUT	Request To Send
5	CB	IN	Clear To Send
6	CC	IN	Data Set Ready
7	AB	—	Signal Ground
8	CF	IN	Received Line Signal Detector
9	—	OUT	Balanced Transmit Data + (RS-422-A)
10	—	OUT	Balanced Transmit Data – (RS-422-A)
11	—	OUT	Secondary Request To Send
12	—	—	No Connection
13	—	—	No Connection
14	—	IN	Balanced Receive Data + (RS-422-A)
15	—	IN	Balanced Receive Data – (RS-422-A)
16	—	—	No Connection
17	—	—	No Connection
18	—	—	No Connection
19	SCA	OUT	Secondary Request To Send
20	CD	OUT	Data Terminal Ready
21	—	—	No Connection
22	—	—	No Connection
23	—	—	No Connection
24	—	—	No Connection
25	—	—	No Connection

- Received Data (BB) (Input)

  Received Data carries the stream of data bits generated by the DCE and received by the TCS.

- Request to Send (CA) (Output)

  In the TCS, Request to Send (RTS) is always on immediately after the power-up sequence and self-tests have finished executing. RTS remains on except during a reset, a long break, or if the power to the TCS is switched off.

NOTE

This use of Request to Send complies with the RS-232-C standard, but precludes operating the TCS in half-duplex mode.

- Clear to Send (CB) (Input)

  The TCS polls Clear to Send (CTS) each time a character is due to be transmitted to the DCE over the serial link. If CTS is off, the character is not sent. When the

DCE switches CTS off, transmission from the TCS halts on the next character boundary.

Normally, the standard does not allow the DCE to switch CTS high or low at random. However, this technique is commonly used to allow the DCE to halt transmission from the TCS via a hardware signal. Allowing switched operation of CTS to halt transmission is compatible with operation as described by the RS-449 standard.

- Data Set Ready (CC) (Input)

  Data Set Ready (DSR) is set on by the DCE when ready for operation. The TCS polls DSR before every character transmission to the DCE. If DSR is off, the character is not sent to the DCE.

- Data Terminal Ready (CD) (Output)

  Data Terminal Ready (DTR) is switched on by the TCS as soon as the power-up sequence and self-tests are concluded. DTR remains on at all times, except during a reset or long break. DTR is switched off for the duration of the reset or long break signal and is reasserted on following the break regardless of the state of DSR.

  The RS-232-C standard specifies that once DTR is switched off by the terminal, DTR may not be driven on again until Data Set Ready from the DCE is switched off. Since the TCS supports a minimal three-wire RS-232-C interface where unconnected control circuits such as DSR are biased on, the operation of DTR is independent of DSR.

- Received Line Signal Detector (CF) (Input)

  Received Line Signal Detector (RLSD) is switched on by the DCE whenever the DCE detects a suitable primary carrier in the receive state. The primary carrier is the telephone line connection, or if a null-modem cable is used, the proper hard-wired connection. RLSD allows one station to determine whether the station at the other end has valid contact. If RLSD is off, the Received Data line is ignored by the TCS.

- Secondary Request to Send (SCA) (Output)

  Secondary Request to Send (SRTS) is switched off by the TCS whenever the TCS sends an XOFF (transmission off) to the DCE. SRTS is switched on by the TCS whenever it sends an XON (transmission on) to the DCE. The SRTS line may be used by the TCS to halt transmission from the DCE. For more information about XON/XOFF, see the heading, Host Interface XON/XOFF Control, later in this section.

NOTE

SRTS also appears on pin 11 of the RS-232-C connector, for use by data communication equipment that implements the RS-232-B pinout.

Balanced Transmit and Receive Data (RS-422-A)

The RS-422-A standard defines an alternative communication method to RS-232-C. Both communication methods share the same connector on the TCS. RS-422-A offers longer distances than RS-232-C. The TCS supports both the RS-232-C and RS-422-A standards. The TCS will also communicate with equipment with an RS-485 interface. The RS-485 standard interface operates the same as RS-422-A, but with some additional capability, including multidrop. The 1020 Series TCS does not support the multidrop function of RS-485.

Unlike RS-232-C, RS-422-A uses a pair of balanced lines to carry each data channel. With RS-232-C, transmitted and received data are each carried on a single data line that is referenced to signal ground. With RS-422-A, transmitted and received data are each carried on a pair of balanced-voltage data lines that are independent of signal ground; the balanced lines carry the data as a differential signal.

RS-422-A can be used with RS-232-C control signals, or XON/XOFF protocol. XON/XOFF protocol is described later in this section, under the heading, Host Interface XON/XOFF Control.

RS-422-A should be used under the following conditions:

- The interconnecting cable is too long for effective unbalanced operation. RS-232-C suggests a limit of 15 meters (50 feet) between stations. Using RS-422-A, that distance can be up to 1200 meters (4000 feet). (See the heading, RS-422-A Resistive Termination, for more information.)
- The interconnecting cable is exposed to excessive extraneous electrical noise sources. The RS-422-A standard has higher noise immunity than RS-232-C.
- Interference with other signals must be minimized.
- The signals must be inverted. (The signals can be inverted simply by reversing the leads at one end of each pair of data lines.)
- Ground loop problems exist.

RECOMMENDED CABLING

Several cabling approaches are available with the TCS. In all cases, cables should be shielded. Cables may be ordered directly from a Fluke Sales and Service Center.

The minimum cabling required to send data to and from the TCS is the three-wire interface consisting of Transmit Data (pin 2), Receive Data (pin 3), and Signal Ground (pin 7) lines of the RS-232-C connector. The RS-232-C port is capable of sending and receiving data using this minimum connection. However, if the host computer does not use XON/XOFF protocols, the lack of handshaking lines may result in lost data at higher baud rates. For more information on timing, refer to the heading, Host Communication Considerations, later in this section. Figure 3-1 shows an example of a minimum RS-232-C cable configuration between the TCS, which is Data Terminal Equipment (DTE) and Data Communication Equipment (DCE).

The RS-232-C connector on the TCS provides several hardware handshaking lines. These lines can be used if the DCE requires certain hardware signals to stop and start

data communication. Optional cables that implement these lines may be purchased from a local Fluke Sales and Service Center.

Null-modem cables are used when connecting the TCS to another DTE, such as a terminal, a Fluke 1722A, or an IBM PC. The Fluke Y1062 Null-Modem Cable is a standard RS-232-C interface cable, 3 meters long, with female connectors on each end. The necessary lines in the Y1062 are crossed to change the TCS standard terminal-type interface into a standard modem-type interface (the cable acts as a substitute for a modem). The wiring of the Y1062 is shown in Figure 3-2.

Standard (straight through) cables are used when connecting the TCS to a DCE (such as a modem). The Y1707 and Y1708 extend the RS-232-C interface on the TCS without changing its function. The male connector on one end of these cables is connected, pin for pin, to the female connector on the other end. The Y1707 is 2 meters long, and the Y1708 is 10 meters long. A schematic of the Y1707 and the Y1708 is provided in Figure 3-3.

The RS-422-A balanced transmit and receive data lines can be used as an alternative to the RS-232-C lines. When using RS-422-A, the balanced transmit data (BTD+ and BTD-) lines are connected to pins 9 and 10, and the balanced receive data (BRD+ and BRD-) lines are connected to pins 14 and 15. (Connector pin assignments are shown in

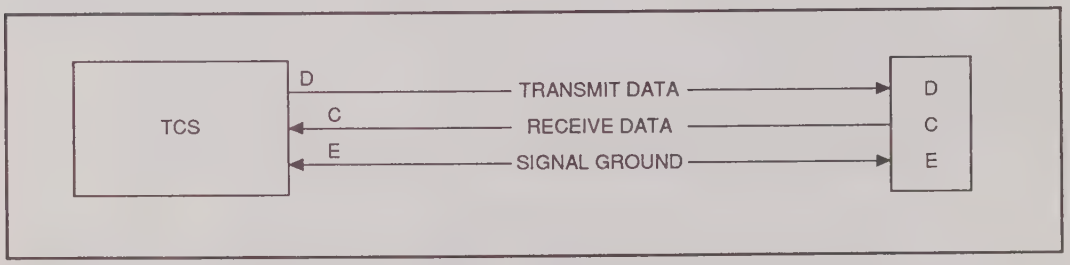


Figure 3-1. Minimum RS-232-C Cable Configuration

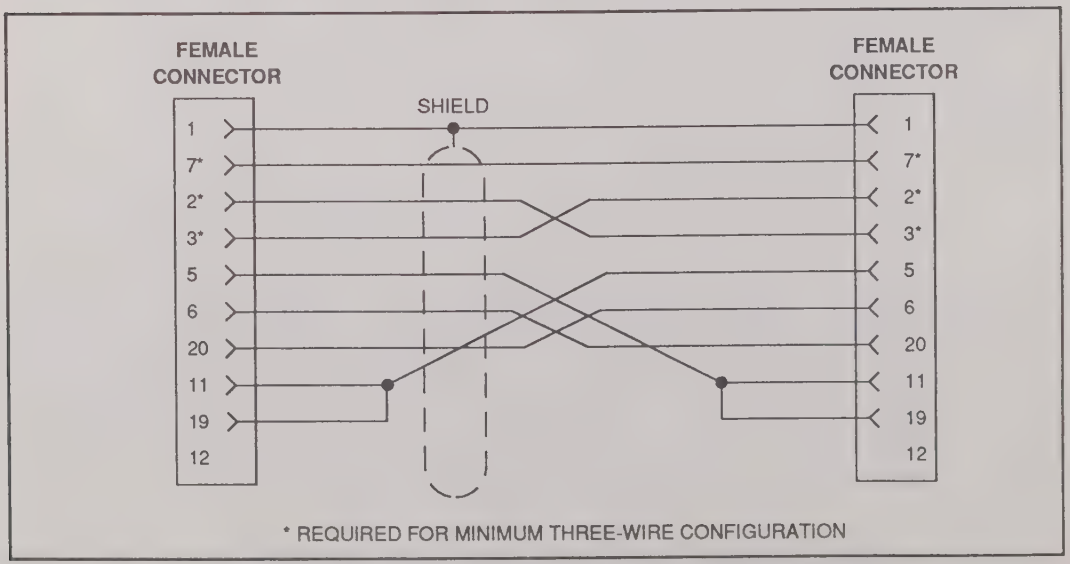


Figure 3-2. Y1062 RS-232-C Null-Modem Cable Wiring Diagram

RS-422-A RESISTIVE TERMINATION

The RS-422-A standard suggests a maximum cable length of 1200 meters (4000 feet) at 19200 baud when using 24 AWG twisted-pair copper conductor cable with a shunt capacitance of 16 pF per foot (telephone type cable), terminated in a 100-ohm resistive load.

Resistive termination should always be used when using TCS in an RS-422-A system. The termination resistors preserve signal rise times while reducing signal amplitude,

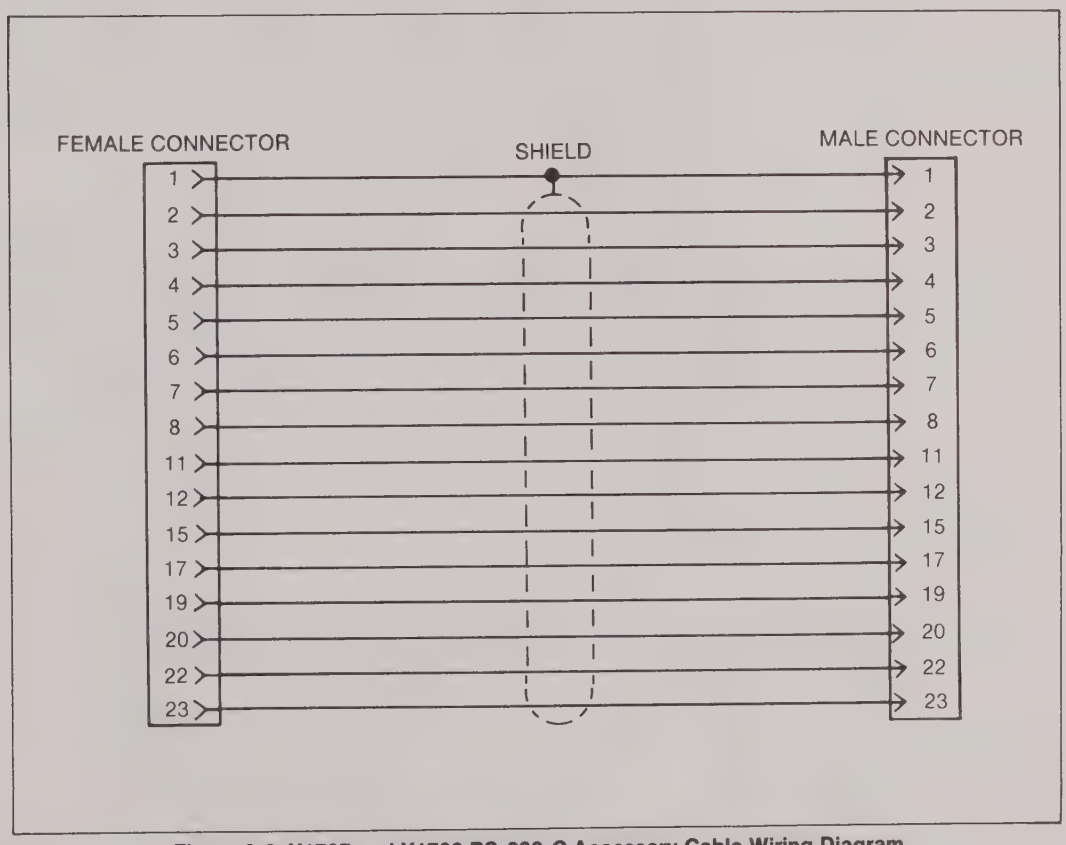


Figure 3-3. Y1707 and Y1708 RS-232-C Accessory Cable Wiring Diagram

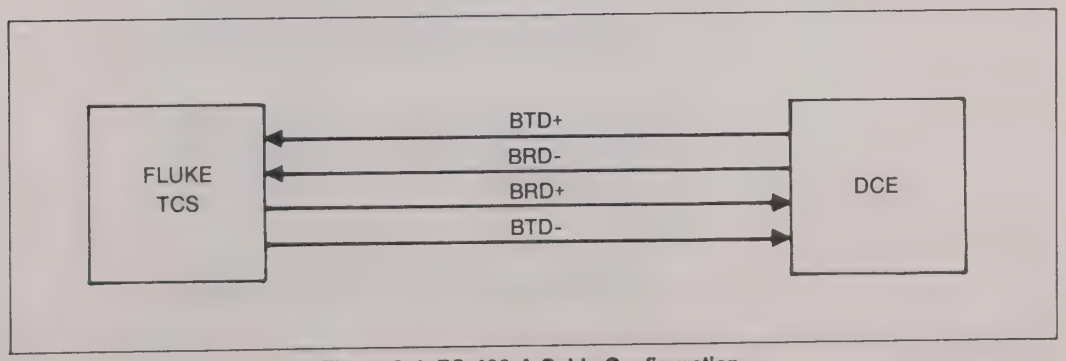


Figure 3-4. RS-422-A Cable Configuration

and provide a default logic state to prevent spurious codes when all drivers are tristated.

CAUTION

To prevent electrical noise from causing framing errors and spurious characters on the display, be sure that all serial interface cables are secure and that the termination resistor switches are properly set.

The TCS is factory configured for resistive termination. To verify this setting, check the configuration DIP switch on the Logic Board (S2). Switch S2 is easily accessible through a rectangular hole in the bottom of the TCS chassis. To enable resistive termination, set switch positions 5, 6, 7, and 8 to closed (on). See Figure 3-5 for an illustration of all switch S2 settings.

HOST COMMUNICATION CONSIDERATIONS

Baud Rate

The TCS supports continuous operation at 9600 baud over the RS-232-C interface without the use of XOFF and XON characters, providing that all the characters sent to TCS are displayable. If high throughput is desired, extremely time-intensive command characters, such as successive requests to clear the entire screen, should be avoided. The TCS supports implementation of such a stream of command characters, but eventually requires that the host be stalled momentarily. Since the TCS is designed to operate with a minimum RS-232-C cable requirement of three wires (Transmitted Data, Received Data, and Signal Ground), a lack of handshaking signals may cause loss of data if the host computer does not support XON/XOFF protocols.

Host Interface Buffering Limitations

NOTE

In the following description, input buffer refers to the buffer containing input from the host to the TCS, while output buffer refers to the buffer containing output from the TCS to the host.

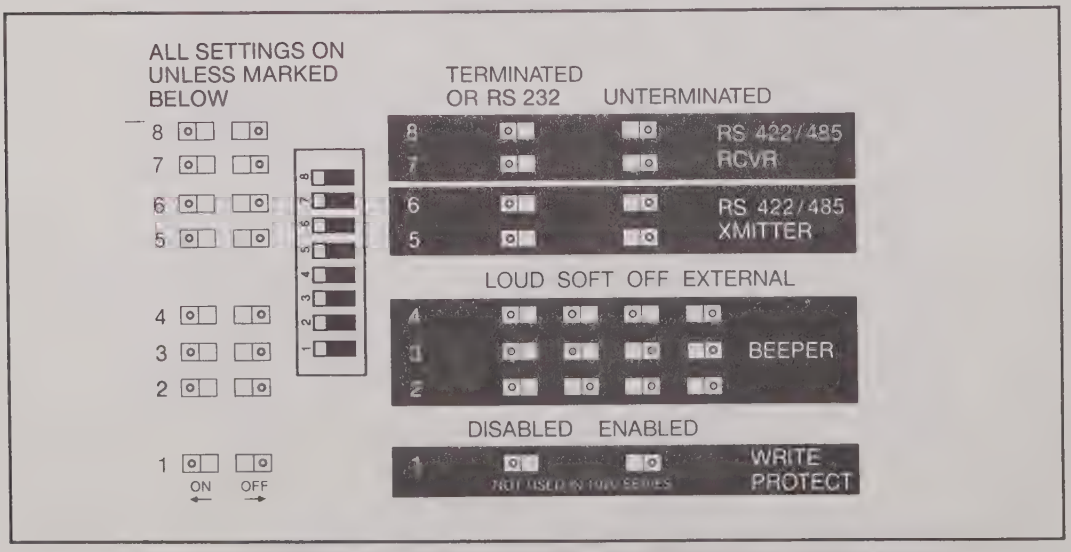


Figure 3-5. Configuration DIP Switch Accessible Through the Chassis Bottom

The TCS contains an input and an output buffer for communicating with the host. The purpose of these buffers is to even out short-term differences in communication throughput between the TCS and the host. Long-term differences in throughput are handled through XON/XOFF control (see the heading, Host Interface XON/XOFF Control, later in this section), or through the RS-232-C handshaking lines.

The TCS output buffer can become full when the host is holding off the TCS with an XOFF or through the RS-232-C handshaking lines. When the TCS output buffer becomes full, any subsequent output, whether the result of user input or status requests by the host, is completely dropped.

Output for the host is always placed in the output buffer as a complete string. Partial reports or other partial strings are not placed in the output buffer. This prevents partially completed output strings from being received by the host. Either the entire string is placed into the output buffer, or the entire string is dropped.

Host Interface XON/XOFF Control

The ASCII characters XON (17 decimal, 11 hex) and XOFF (19 decimal, 13 hex) are sent to the host to prevent the TCS input buffer from overflowing. Similarly, the TCS responds to XON and XOFF from the host to prevent the host's input buffer from overflowing. The following paragraphs describe how the TCS uses and interprets XON and XOFF.

SENDING XOFF TO THE HOST

The TCS gives the host two chances to avoid overflowing the TCS input buffer: first when the input buffer is 75% full, and again when overflow begins to occur.

The user can cause the TCS to send an XOFF to the host by pressing keys on the optional keyboard. In particular, the TCS sends an XOFF to the host (and switches the SRTS line low) when Ctrl/S is pressed (by holding down the Ctrl key while typing S).

SENDING XON TO THE HOST

The TCS sends an XON character to the host (and switches the SRTS line on) when any of the following conditions exists:

- The input buffer is emptied by the TCS, and the previous hold-off character sent to the host was XOFF.
- A Reset command has been completed, and the TCS is ready to receive input from the host.
- Ctrl/Q is pressed (by holding down the Ctrl key while typing Q).

SENDING XOFF TO THE TCS

After receiving XOFF, the TCS ceases all transmission to the host on the next character boundary.

SENDING XON TO THE TCS

After receiving XON, the TCS resumes transmission to the host.

NOTE

XON and XOFF are not treated like any other characters received by the TCS. Since XON and XOFF only control the communication flow between the TCS and the host, the TCS can legitimately handle XON and XOFF even when the TCS input buffer is full.

User Interface Control

The user interface normally has very little overhead associated with its control. However, certain conditions exist where the normal information flow is modified.

DISPLAY SCROLL CONTROL

Information flow from the host to the TCS screen may be stopped or started using the Scroll Lock key on the keyboard. The Scroll Lock key has a toggle function; it is pressed to stop information flow from the host and pressed again to resume information flow.

For example, if the Scroll Lock key is pressed while scrolling is unlocked (the Scroll Lock keycap LED is off), the Scroll Lock keycap LED turns on, signifying that the display scroll is locked. This stops interpretation of host input by the TCS.

If the Scroll Lock key is pressed while scrolling is locked (the Scroll Lock keycap LED is on), the Scroll Lock keycap LED is turned off, signifying that the display scroll is unlocked. The display is updated by the host, continuing from the point when the display scrolling was locked.

NOTE

Scroll lock freezes the display whether or not the host supports flow control. If the host does not support flow control, a buffer overflow error may be displayed when scrolling is resumed.

Ctrl/S and Ctrl/Q also start and stop the updating of the display if the host supports flow control.

USER INPUT DISABLE

User input via the keyboard or touch panel can be disabled under the following circumstances:

- Touch Panel Lockout Mode

  If the Touch Panel Lockout Mode is set, user input from the touch panel is ignored. Touch panel entries that normally exhibit an automatic response no longer exhibit this response. This indicates that a touch entry is not being processed normally. Changing Touch Panel Lockout Mode is accomplished by a command from the host computer. (For more information, see the heading, Touch Panel Lockout Mode Command, in Section 6 of the Programmer's Guide).

- Keyboard Lockout Mode

  If the Keyboard Lockout Mode is set, user input from the keyboard is ignored. This precludes using the Setup Screen unless the user has access to the rear panel

SET UP switch. The Keyboard Lockout Mode is ignored when the user is inside the Setup Screen.

- Setup Lockout Mode

  If the Setup Lockout mode is set, the user is locked out of the Setup Screen and the host has complete control of the TCS. This is useful in situations where the designer does not want to lock out the entire keyboard or make the rear-panel SET UP switch inaccessible, but wants to prevent the user from changing the TCS functionality in any way.

- Output Buffer Full

  If the TCS output buffer is full of status reports requested by the host or user inputs from the touch panel or the keyboard that have not yet been read by the host, user input is temporarily disabled until more room exists within the output buffer.

DIP SWITCH AND JUMPER DEFINITIONS

Table 3-2 summarizes the jumper settings for the TCS. Figure 3-5 shows all configuration DIP switch settings.

THE CUSTOM CONNECTORS

With Option 1021-60, the TCS features a female 25-pin D Custom Connector and a female 15-pin D Custom Video Connector, which allow external access to selected internal signals on the Logic Board.

The Custom Connector provides pins for the following functions:

- External beeper
- External setup switch
- DC power inputs/outputs
- External keyboard
- External contrast control
- AC line lock
- Reset

Pin Definitions

The Custom Connector and the Custom Video Connector are located on the rear of the TCS chassis. Pin definitions for the two connectors are shown in Tables 3-3 and 3-4.

Table 3-2. Jumper Settings

JUMPER POSITION	STATE	DESIRED OPERATION
W9 W10	IN IN	Internal contrast potentiometer.
W9 W10	OUT OUT	External contrast potentiometer.
W11 W12	IN OUT	Factory test. Must be in position shown.

IN = Installed OUT = Not installed.

Table 3-3. Custom Connector Pin Definitions

PIN	DEFINITION
1	Chassis Ground
2	+12V
3	Logic Ground
4	-12V
5	Logic Ground
6	+5V
7	Keyboard Reset-
8	Keyboard Clock
9	Setup-
10	External Beeper Enable-
11	Not Used
12	Not Used
13	Not Used
14	+12V
15	Logic Ground
16	-12V
17	Logic Ground
18	+5V
19	+5V
20	Keyboard Data
21	ACLL-
22	Reset-
23	Not Used
24	Not Used
25	Not Used

Table 3-4. Custom Video Connector Pin Definitions

PIN	DEFINITION
1	Chassis Ground
2	Logic Ground
3	Logic Ground
4	Logic Ground
5	Vertical Sync
6	Horizontal Sync
7	Logic Ground
8	Video In
9	Reserved for Future Use
10	Reserved for Future Use
11	Reserved for Future Use
12	Vertical Sync-
13	Horizontal Sync-
14	Composite Video
15	Contrast

Cabling

Cabling should be as short as possible and just long enough to reach from the rear of the TCS to the panel the unit is mounted in. Cabling requirements are different for some functions; refer to each function for details.

Shielding

Each conductor on the Custom Connector carries noise generated by the display, power supply and digital circuitry. Shielding is required to limit radiation and meet U.S. FCC and German VDE emission limits. Both the connector shell and body should be shielded. To maintain compliance with electromagnetic interference (EMI) limits, use Belden cable, P/N DBM-43-001-2-04, or one with equivalent shielding.

The cable shield should be connected to chassis ground through the connector shell or pin 1. Other connections may cause signal path (ground loops) that compromise the emissions compliance of the unit, or cause noise-induced problems in the logic. Individual signals may also require shielding from each other.

How to Use the Custom Connector and the Custom Video Connector

The following paragraphs describe the signals available on the Custom Connector and the Custom Video Connector, and demonstrate some typical cable connections and interface circuitry. Some signals are always available at the connectors; others are available by switching internal connections to the connectors through jumper changes on the Logic Board. See Figure 3-6 for jumper locations. Some functions of the two connectors are modified by jumpers or configuration switch settings, as indicated in Figure 3-5 and Table 3-2.

BEEPER

The internal beeper can be turned off, or its volume can be increased or decreased by changing the setting of switch S2 on the Logic Board. If switch S2 positions 2, 3, and 4 are closed (on), the beeper volume is loud. If position 2 is open (off) and 3 and 4 are closed (on), the beeper volume is soft. If positions 2 and 3 are open (off) and 4 is closed (on), the internal beeper is off. Switch S2 is accessible through a hole in the bottom of the TCS chassis.

An external beeper may be enabled and the internal beeper turned off by setting switch S2 positions 2, 3, and 4 to open (off). The External Beeper line (pin 10) is driven low by a 75454 TTL, open-collector driver that sinks up to 100 mA for the duration of the beep.

If S2-4 is closed (on), the external transducer will receive the same pulse train as the internal beeper. This is useful for transducers that do not self-oscillate.

If S2-4 is open (off), the external transducer receives the same enable signal that the internal pulse train generator receives. This configuration is useful for transducers that self-oscillate.

If capacitive transducers are used, a parallel resistor must be used to provide bias current to the open collector output. If inductive transducers are used, a parallel flyback diode must be used to protect the output from the inductive kickback. See Figure 3-7.

EXTERNAL SETUP SWITCH

The Setup Screen may be entered remotely by introducing a logic-low signal on pin 9 of the Custom Connector. A switch with normally-open contacts connected to the TCS ground, or an open-collector TTL-level driver should be used to implement the signal. The minimum duration of the logic-low signal for setup is 150 ms. See Figure 3-8.

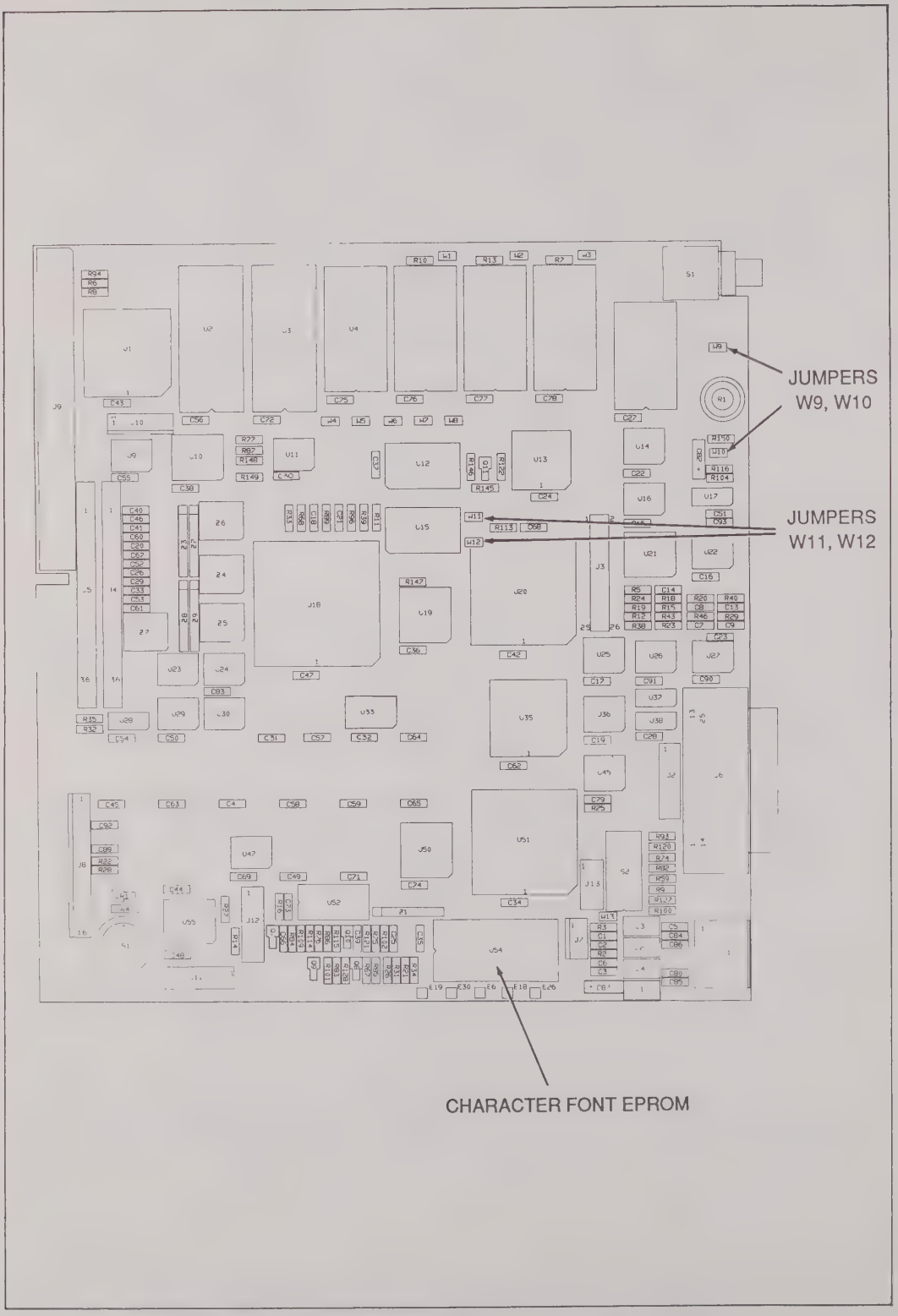


Figure 3-6. Character Font EPROM and Jumper Locations

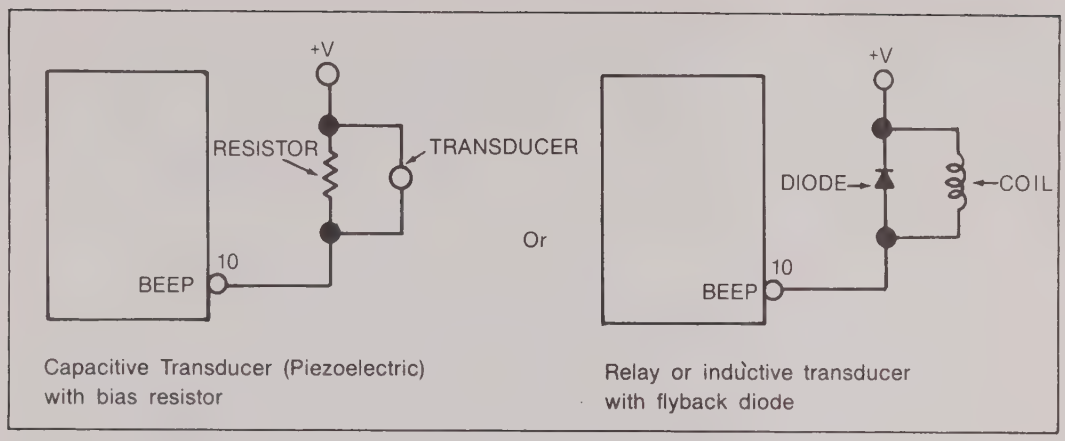


Figure 3-7. External Beeper Connection

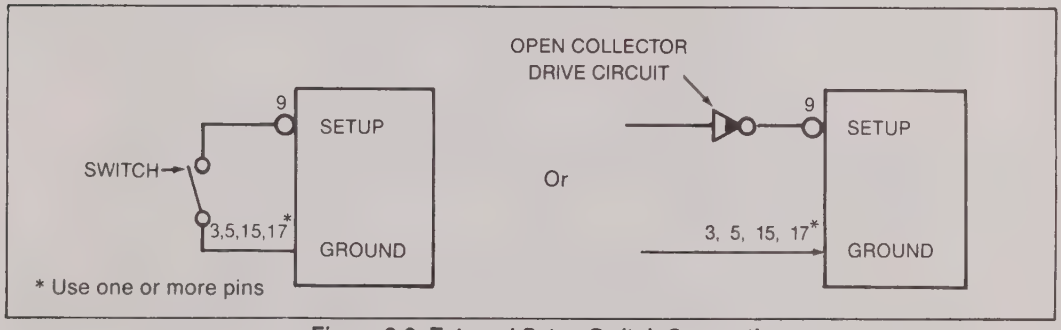


Figure 3-8. External Setup Switch Connection

VOLTAGES

The TCS may be powered from the Custom Connector, as shown in Figure 3-9. When using an alternate power supply, apply +5V dc to pins 6, 18, and 19 of the Custom Connector, +12V dc to pins 2 and 14, and -12V to pins 4 and 16. Connect pins 3, 5, 15, and 17 to ground. The voltage and current requirements for the TCS are listed in Table 3-5.

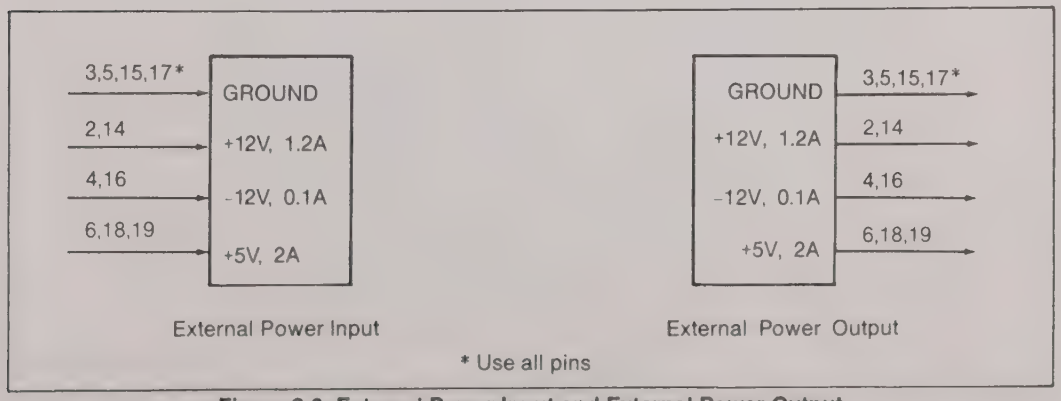


Figure 3-9. External Power Input and External Power Output

Table 3-5. Required Supply Voltage and Current Specifications

PIN	VOLTAGE	CURRENT	RIPPLE VOLTAGE (RMS)
6, 18, 19	+5V dc, ±5%	2.0A	50 mV
14, 2	+12V dc, ±5%	1.2A	100 mV
16, 4	−12V dc, ±5%	0.1A	100 mV

NOTE

The TCS should not be simultaneously powered from the pins on the Custom Connector and the power supply.

If the TCS is powered through the ac line cord, the +5V dc and +12V dc voltages on the Custom Connector may be used to power other devices, as shown in Figure 3-9. The maximum current available for this use is 0.5A on the 5V pins, 0.5A on the +12V pin, and 0.1A on the -12V pin. If these pins are used as a source of dc voltage, the temperature rating of the TCS is derated by 1°C per watt consumed by external devices.

CAUTION

Certain non-constant loads can cause the TCS to perform unreliably. Loads in excess of recommended limits can damage the TCS.

ALTERNATE KEYBOARD SIGNALS

The regular keyboard cable can be extended using a Keyboard Extender Cable Accessory (Y-1085), a standard shielded DIN audio cable, or by constructing an alternate keyboard interface. The Custom Connector supplies three lines, Keyboard Reset (pin 7), Keyboard Data (pin 20), and Keyboard Clock (pin 8), that run directly to the keyboard connector on the Logic Board, as shown in Figure 3-10. These lines allow the designer to construct an alternate keyboard interface. Note that a keyboard attached to the Custom Connector cannot be run in parallel with a keyboard attached to the Keyboard Connector.

EXTERNAL CONTRAST

An external contrast control may be added to the TCS. To construct an external contrast control, connect the CONTRAST line (pin 15), the VIDEO In line (pin 8), and

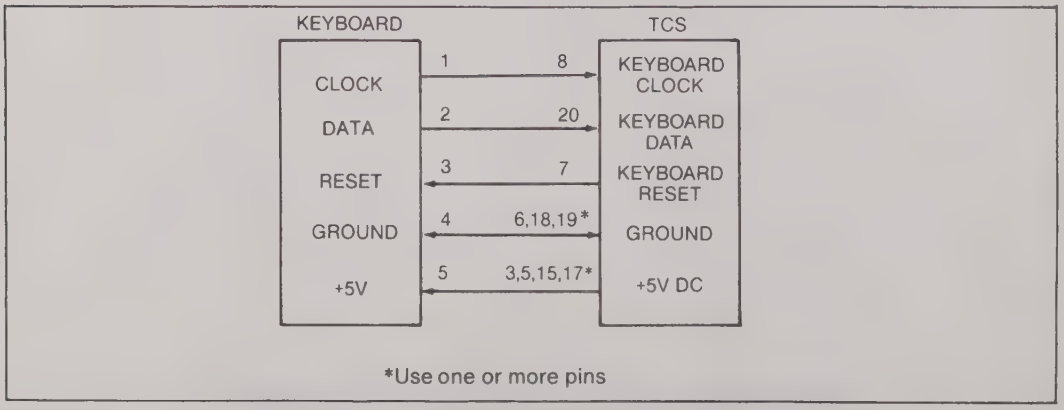


Figure 3-10. External Keyboard Connection

GND (pins 2,3, or 4) from the Custom Video Connector to a 100Ω potentiometer as illustrated in Figure 3-11. Since the wires used for this control carry the high-frequency 14-MHz video signal, they should be kept as short as possible and should be shielded to prevent excess radio frequency interference (RFI).

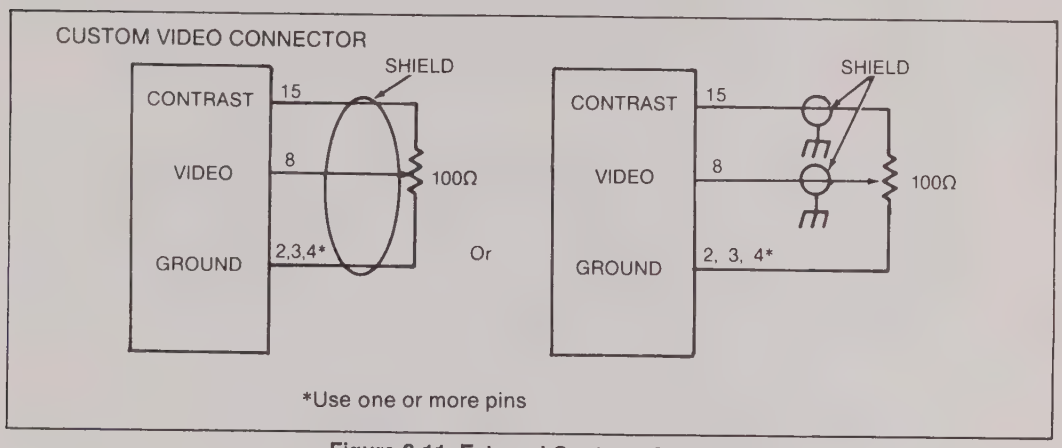


Figure 3-11. External Contrast Connection

External Contrast cabling may affect display quality over long cable lengths. Connection to a front panel control alongside the TCS will generally give acceptable results. Tests should be made if the cable is to be used over longer distances.

To implement the external contrast control, remove jumpers W9 and W10 from the Logic Board. See Figure 3-6 for the locations of these jumpers.

COMPOSITE VIDEO

A composite video signal is available on pin 14 of the Custom Video Connector, as shown in Figure 3-12. This signal is designed to comply with EIA RS-170 and may be used to drive an external monitor. A shielded cable should be used to minimize radio frequency interference. The cable should have a characteristic impedance of 75Ω.

NOTE

Horizontal frequency is 16.74 kHz, as opposed to RS-170 standard 15.75 kHz. Most, but not all, composite video monitors will accommodate this difference.

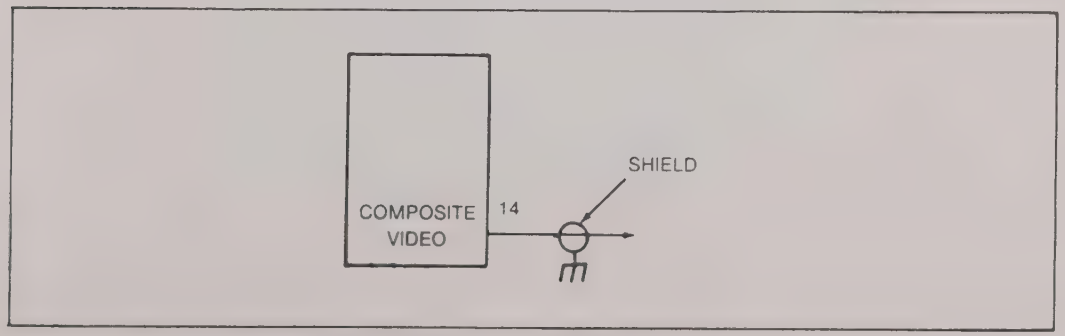


Figure 3-12. Composite Video Connection

AC LINE LOCK

The local line frequency creates magnetic fields that can vary at frequencies different from the CRT-refresh rate and cause disturbances in the display. To prevent magnetic fields from affecting the display, locate transformers and motors as far from the CRT as possible. In the rare cases where this method is ineffective or impossible, the AC Line Lock (ACLL) signal can be used to synchronize the CRT refresh with the local line frequency, minimizing the effect of stray magnetic fields.

The ACLL pin (pin 21) can be driven by a totem-pole or open-collector TTL-level signal. The signal should be an approximate square wave synchronized to the local line frequency. As long as pin 21 is held low, the display beam is prevented from beginning another scan. As soon as the line goes high, the beam begins to scan across the display. The ACLL signal can slow the display refresh rate if the local line frequency is less than 60 Hz. The local line frequency affects the vertical position of the display and must be fairly stable. The minimum input frequency is 47 Hz. See Figure 3-13 for an example circuit connection.

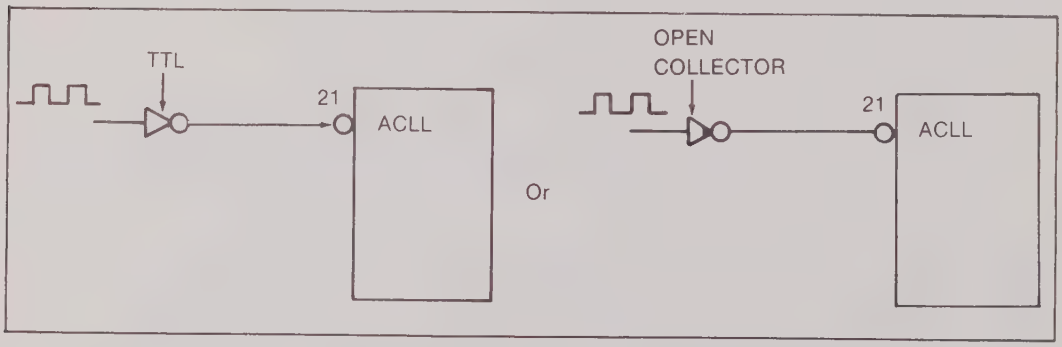


Figure 3-13. AC Line Lock Connection

RESET

The TCS reset may be controlled remotely by applying a TTL logic-low signal to pin 22 of the Custom Connector, as shown in Figure 3-14. Totem-pole, open collector, or transistor drivers may be used to force the reset line to the logic low state. Another method is to use a normally open switch that grounds the reset input line when momentarily closed. The minimum low-level duration of the reset pulse signal is 100 us.

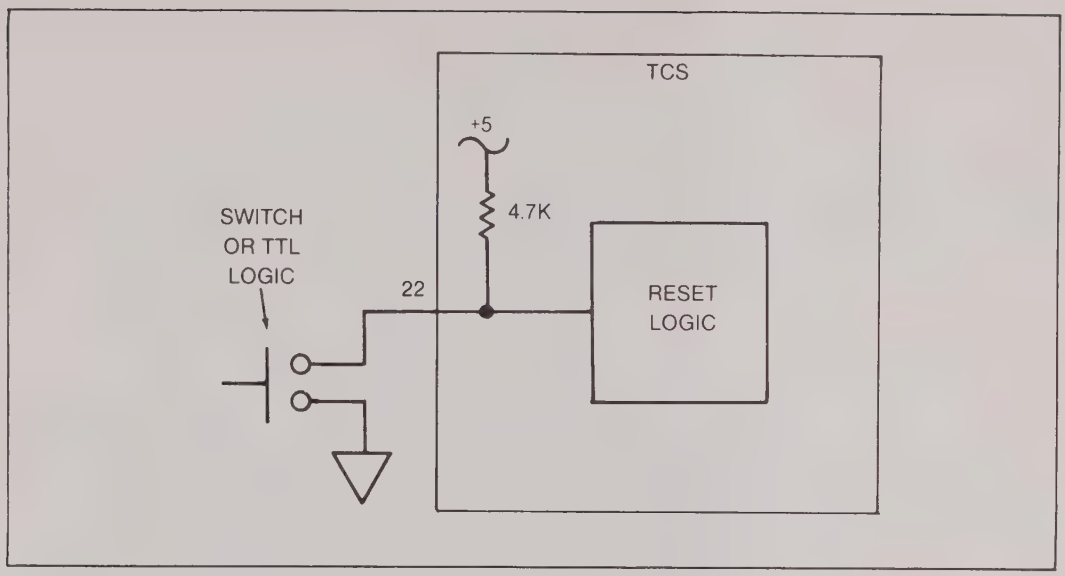


Figure 3-14. External Reset Connection

Section 4
Mechanical Design

INTRODUCTION

This section provides information on mounting the Touch Control Screen (TCS) in a panel, in a rack, or onto a table top. Topics covered in this section include panel mounting considerations, available rack mounting hardware, table top mounting instructions, and environmental considerations.

The model 1021 TCS is furnished in a non-enclosed chassis configuration suitable for mounting directly to a panel or in a rack (see Figure 4-1). An optional plastic enclosure (Option 1021-30) and an optional tilt/swivel base (Option 1021-31) are available for applications where the TCS is to be free-standing or mounted on a desk, a floating arm, or a table top (see Figure 4-2).

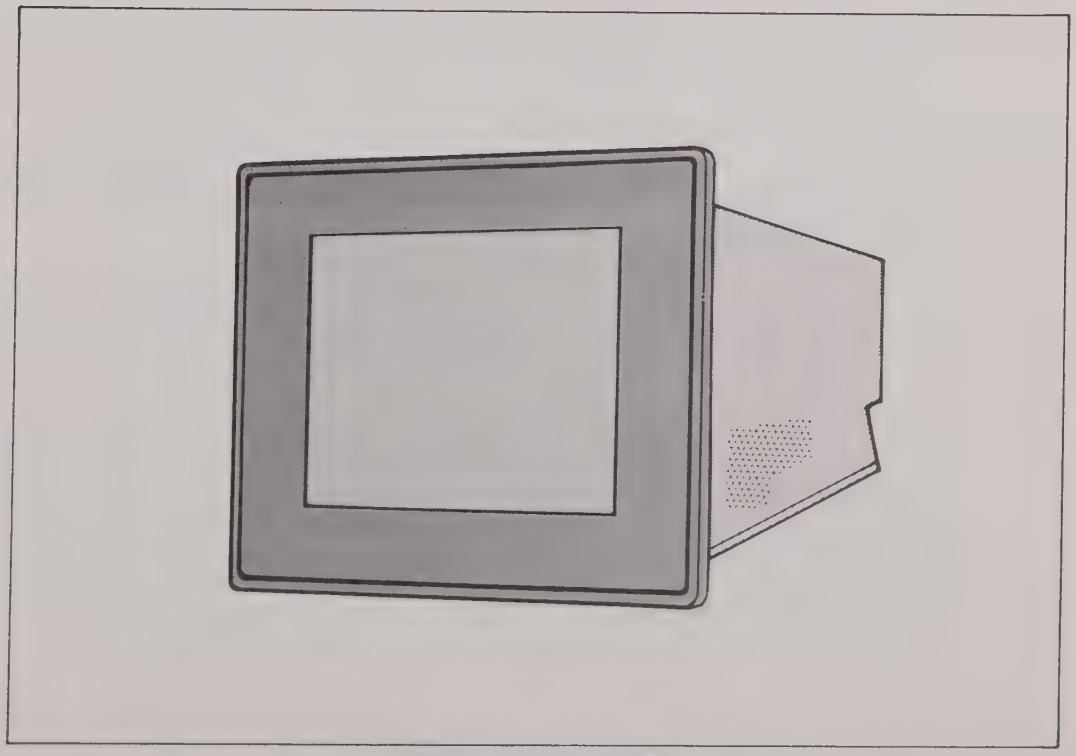


Figure 4-1. The 1021 TCS

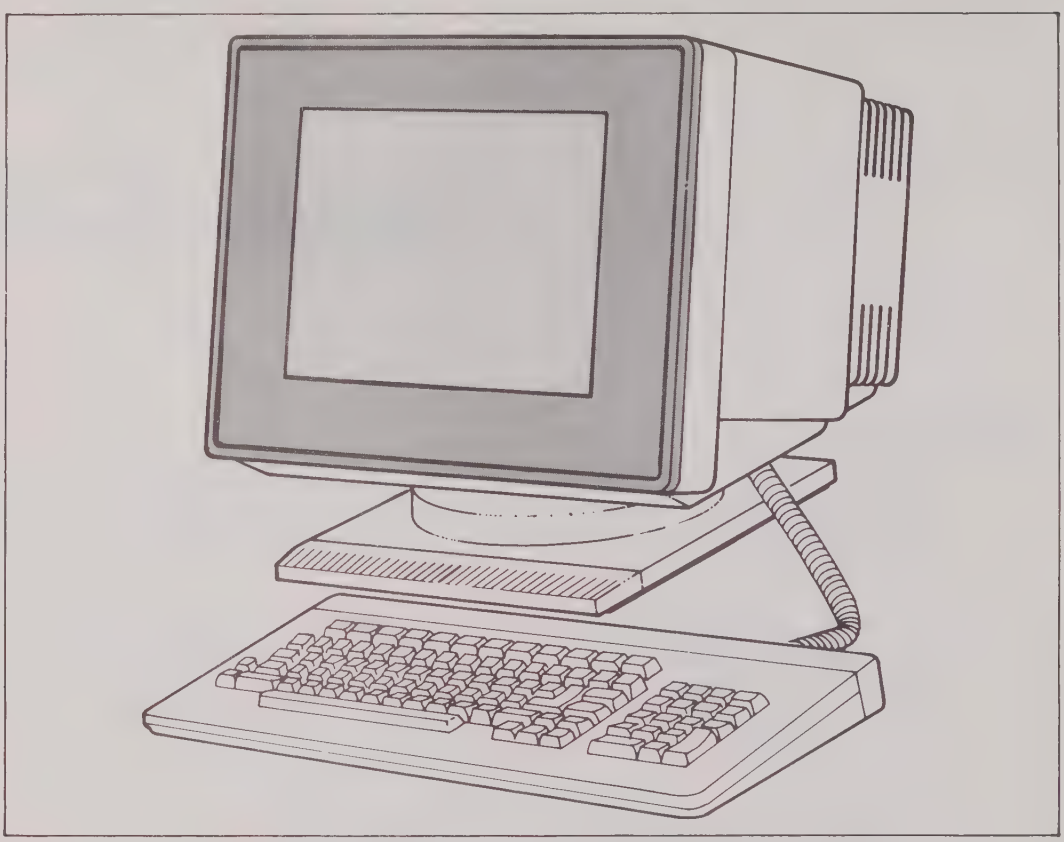


Figure 4-2. The TCS With Optional Enclosure and Tilt/Swivel Base

PANEL MOUNTING CONSIDERATIONS

The TCS is designed to be easily mounted into a simple cutout in a metal, fiberglass, or wood panel, and is supplied with complete hardware for panel mounting. See Figure 4-3 for panel mounting dimensions.

To properly mount the TCS, a hole size of 308 mm (12.13 in) wide by 232 mm (9.13 in) high should be cut in the mounting material. The bottom of the hole should be as level as possible to ensure that the TCS is level while resting on the bottom edge of the panel hole, and that it remains level as the mounting clips are tightened.

Clearances must be allowed on the top, bottom, and sides of the TCS to provide for proper cooling and to allow for the space required for mounting clips. 19 mm (0.75 in) clearance after installation is required for the mounting clips themselves. 70 mm (2.75 in) clearance is recommended to install and tighten the clip. For installations where the TCS will remain mounted during servicing, 89 mm (3.5 in) clearance is recommended below the instrument. This clearance allows removal of the bottom of the chassis, providing ready access to internal components. This measurement is referenced to the bottom surface of the chassis at the panel cutout and enables the bottom chassis cover to swing open 21 degrees.

The depth of the TCS from the back of the bezel to the back of the chassis is 299 mm (11.78 in). An additional 82 mm (3.22 in) should be allowed for the power cord and a

standard RS-232-C cable, for a total depth of 381 mm (15 in). In applications where it is necessary to bend the cable to a radius of more than 5 times the cable's diameter, the designer may chose to cut holes in the rear of the enclosure, or to obtain cables with right angle connectors.

The thickness of panel materials chosen depends on the size of the mounting panel, the location of the TCS in the panel, environmental conditions, and other factors. The TCS fasteners accept panel materials up to 20 mm (0.8 in) thick. Fluke recommends a thickness of 5 mm (0.188 in) or above for aluminum and 3 mm (0.125 in) or above for steel in standard applications. Large panels may require thicker materials and/or stiffeners.

The TCS is designed with three mounting clips that attach to the top and bottom of the TCS metal chassis. Tightening the bolts on the clips exerts pressure against the panel material, clamping the TCS in place. Three indents on the lip of the metal chassis allow the TCS to accommodate panels with a small amount of warp. In cases where the panel material is overly flexible, extra clips (P/N 801431) can be ordered and placed one on each side of the metal enclosure to provide more support. The extra clips help to distribute the mounting forces of the TCS over a greater surface area and help to prevent cracking or warping of panel materials.

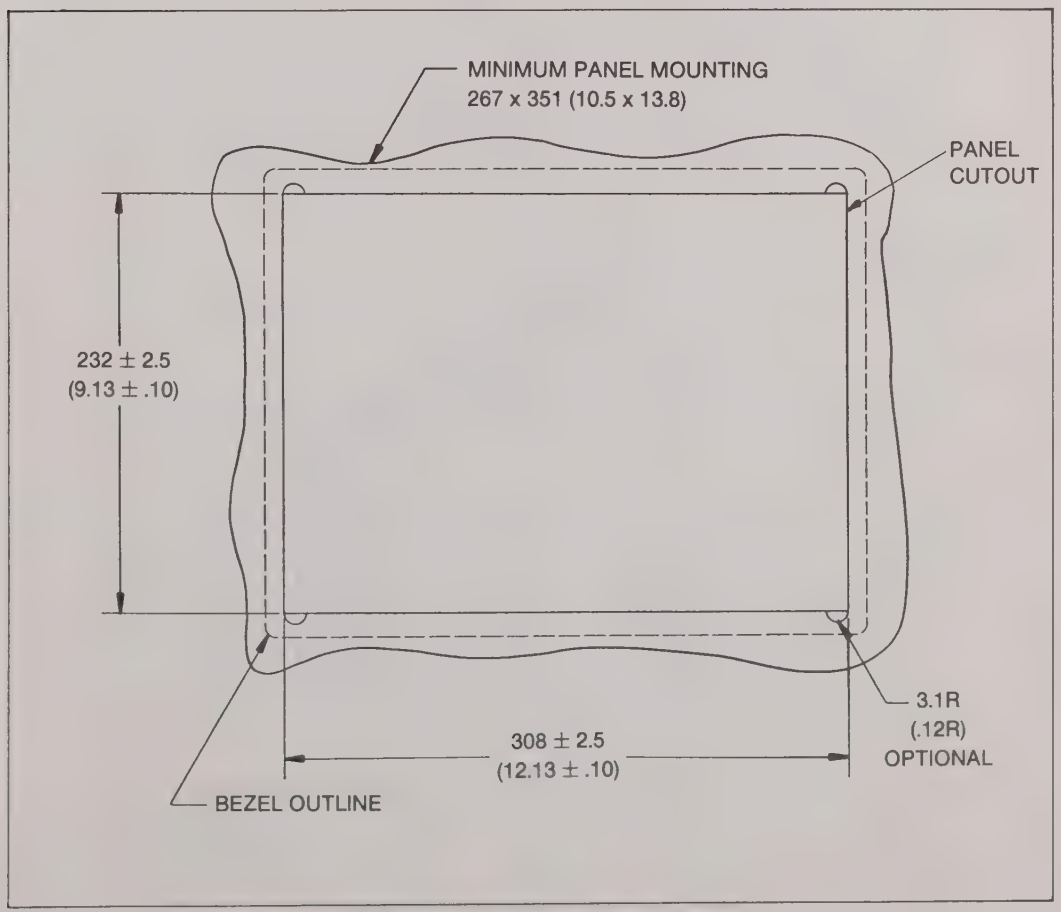


Figure 4-3. Panel Mounting Dimensions

PANEL MOUNTING THE TCS

Use the following procedure to mount the TCS in a panel.

1. Push the TCS into the hole in the panel as shown in Figure 4-4.

2. Install one mounting clip on the top and two clips on the bottom of the TCS chassis as shown in Figure 4-5. A screwdriver is required to install the clips.

3. Tighten the screws in the clips until the chassis is held snugly against the panel (a torque of 13.6 newton-meters (10 ft-lbs) should be sufficient).

RACK MOUNTING THE TCS

Fluke provides three optional rack mounting kits for use in a standard 483 mm (19 in) rack. All three kits occupy six rack units of height, or 267 mm (10.5 in). The Y1080 19-inch rack mount kit provides a sheet metal panel for semi-permanent mounting into the rack enclosure. The Y1081 19-inch rack mount kit and the Y1082 19-inch rack mount kit provide a sheet metal panel and slides to allow the TCS to slide easily in and out of the rack. The Y1081 has 457 mm (18 in) long slides and the Y1082 has 610 mm (24 in) long slides.

Mounting the TCS into a rack panel kit is similar to mounting the TCS into any panel. When using a Fluke rack mount kit, other instruments may be mounted directly above and below the TCS. The TCS should be mounted into the rack panel before it is installed in the system, so that sufficient space is allowed for installing the clips. Complete instructions on mounting the TCS into a rack are included with each rack mount option.

SURFACE MOUNTING

The TCS may be mounted to a horizontal surface, such as a table, in a variety of ways.

Using The Fluke Tilt/Swivel Base Assembly

There are four threaded standoffs on the bottom of the TCS chassis for mounting the Fluke tilt/swivel base assembly. The standoffs accept #6-32 machine screws.

To mount the Fluke tilt/swivel base assembly, four non-metric 5/16 in x #6-32 (0.312 in, 7.8 mm) screws are required along with a 0.8 mm (0.030 in) thick, 8 mm (0.315 in) diameter, #6 flat washer under the head of each screw. The allowable tolerance of the screw length is ± 0.25 mm (0.010 in). The allowable tolerance of the thickness of the flat washer is ± 0.13 mm (0.005 in). These parts are provided with the tilt/swivel option. The two locating pins on the tilt/swivel base must be lined up with the two locating holes on the bottom chassis cover. The base is then tilted and rotated to allow installation of the four mounting screws through the 19 mm (0.75 in) diameter access hole in the base. (See Figure 4-6.)

When using the Fluke tilt/swivel base, the base itself can be secured to another surface using the 19 mm (0.75 in) diameter access hole in the base. A large bolt and flat washer can be applied through the hole and attached to the surface below the base. Fluke does not supply any hardware for this purpose. This method provides minimal restraint for the TCS, and is not recommended for applications where the TCS will experience excessive shock or vibration.

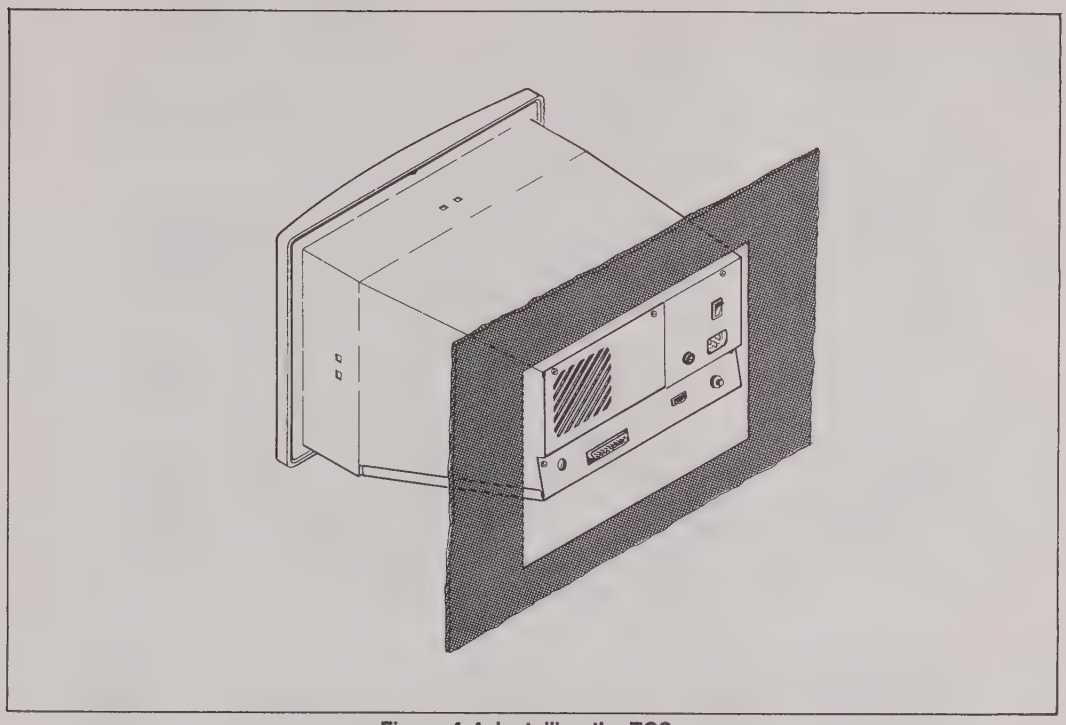


Figure 4-4. Installing the TCS

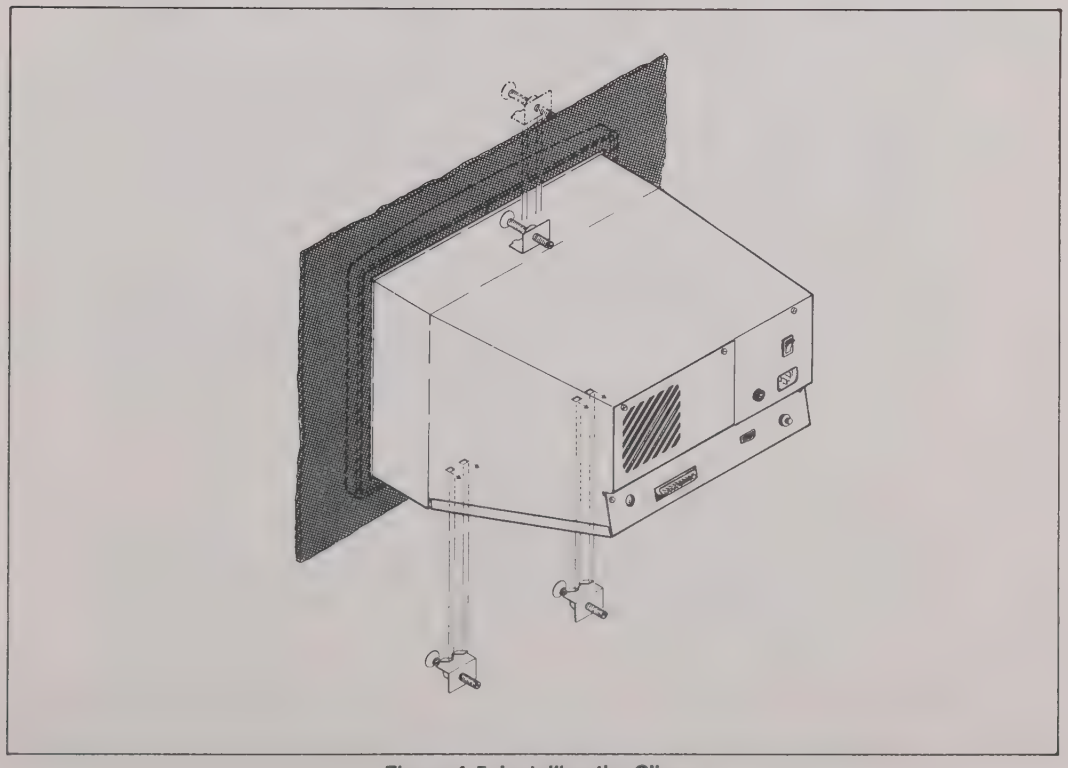


Figure 4-5. Installing the Clips

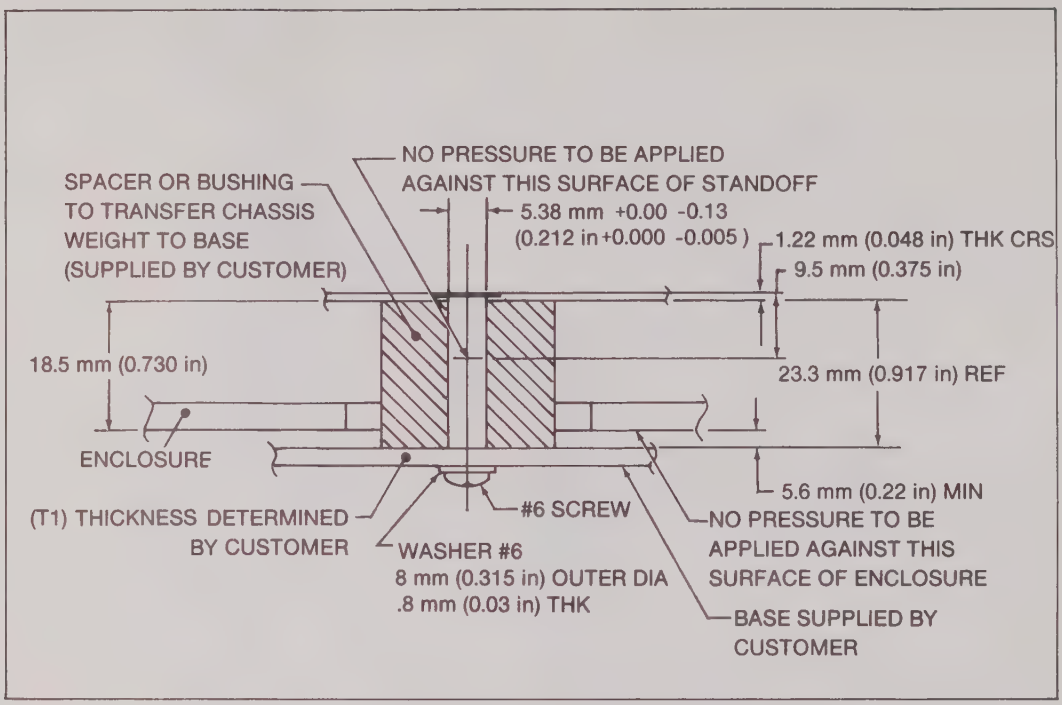


Figure 4-6. Mounting Assembly With the Optional Enclosure

Mounting Configurations Without The Fluke Tilt/Swivel Base Assembly

USING THE OPTIONAL ENCLOSURE

If the optional enclosure (Option 1021-30) is used without the Fluke tilt/swivel base assembly, the enclosure can either rest free on a surface using the integral pads on the enclosure bottom, or be fastened to the surface using four #6-32 screws attached to the threaded standoffs on the chassis bottom. The screw length should be equal to the thickness of the customer supplied base plus 19 mm (0.75 in). The 19 mm (0.75 in) includes a 0.8 mm (0.030 in) flat washer under each screw head, a minimum 5.6 mm (0.22 in) gap between the bottom of the plastic enclosure and the base, and a nominal thread engagement of 3.3 mm (0.130 in). When using mounting screws, a customer supplied bushing (see Figure 4-6) is required at each standoff to ensure that the instrument weight is properly transferred to the base. Use of screws that are too long allows the screws to bottom out in the threaded standoffs before tightening, resulting in an assembly that is not securely fastened.

NOTE

When using mounting screws to install the instrument, do not rest the instrument on the plastic enclosure without support bushings. The enclosure by itself is not designed to support the compression of the TCS when the mounting screws are tightened.

BARE CHASSIS ONLY

If the optional enclosure is not used, the screw length should be equal to the thickness of the customer supplied base plus 4.8 mm (0.190 in). The 4.8 mm (0.190 in) includes a 0.8 mm (0.030 in) flat washer under each screw head, a nominal 0.8 mm (0.030 in) gap

between the standoff and the base created by a customer supplied bushing (see Figure 4-7), and a nominal thread engagement of 3.3 mm (0.130 in). Use of screws that are too long allows the screws to bottom out in the threaded standoffs before tightening, resulting in an assembly that is not securely fastened.

NOTE

The standoffs are not designed to directly support the weight of the chassis. The bushing is required to transfer the weight of the instrument to the base. Directly loading the standoffs with the instrument weight may result in the standoffs being pressed out of the chassis cover.

ENVIRONMENTAL CONSIDERATIONS

The TCS is designed to meet the rigorous environmental conditions found in manufacturing and production environments, but is also at home in the lab or office. The TCS is designed to be highly resistant to environmental contaminants, shock, and vibration, and to operate in a wide range of temperatures. The extensive design work and testing of the 1020 Series Touch Control Screen assures that the TCS will last for the life of a system.

Temperature

The basic TCS is provided without a fan. The TCS is specified for operating temperatures from 0 to 50° C without the optional plastic enclosure and 0 to 40° C with the enclosure. Ambient temperature surrounding the TCS should not exceed these limits.

Although the TCS is extremely long-lived, lower operating temperatures can increase reliability. For every 10 degrees of temperature below the maximum, the mean time between failure of the TCS is approximately doubled.

Improved instrument cooling and reliability can be obtained using an optional fan (P/N 788737). Installation of the fan also increases the TCS temperature specifications to 60° C without the optional plastic enclosure and to 50° C with the enclosure.

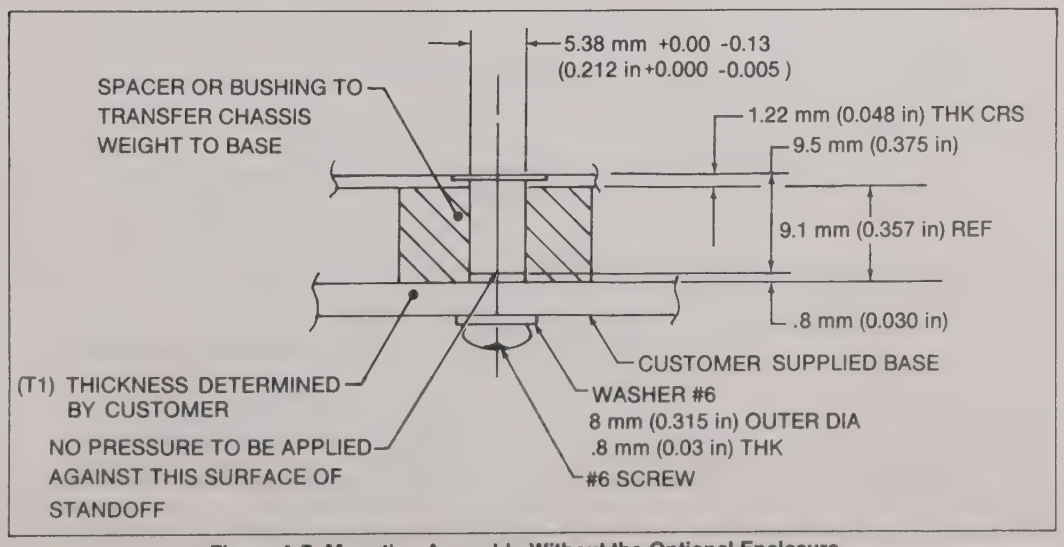

5.38 mm +0.00 -0.13
(0.212 in +0.000 -0.005)
SPACER OR BUSHING TO TRANSFER CHASSIS WEIGHT TO BASE
1.22 mm (0.048 in) THK CRS
9.5 mm (0.375 in)
9.1 mm (0.357 in) REF
.8 mm (0.030 in)
CUSTOMER SUPPLIED BASE
(T1) THICKNESS DETERMINED BY CUSTOMER
NO PRESSURE TO BE APPLIED AGAINST THIS SURFACE OF STANDOFF
WASHER #6
8 mm (0.315 in) OUTER DIA
.8 mm (0.03 in) THK
#6 SCREW

Figure 4-7. Mounting Assembly Without the Optional Enclosure

Resistance To Contamination

To protect the TCS against environmental contaminants, the touch panel is tightly sealed to the plastic bezel. The optional NEMA 12 Panel Mounting Kit (Y1070) may be installed to create an additional seal between the bezel and the mounting panel. Panel mounting the TCS into a NEMA 12 rated enclosure allows for a system configuration that is NEMA rated. The TCS, in a free-standing configuration does not fully meet NEMA requirements due to ventilation holes.

The NEMA 12 Panel Mounting Kit creates a drip-tight and dust-tight seal. The NEMA 12 kit includes a NEMA 12 enclosure gasket and two additional mounting clips. The NEMA 12 gasket is installed on the metal chassis behind the lip that surrounds the front of the TCS. When the TCS is tightened against the panel, the gasket presses down to seal the TCS in place. Complete mounting instructions are provided with the NEMA 12 Panel Mounting Kit.

Shock And Vibration

The 1020 TCS meets military specifications (MIL-T-28800C, class 3) for vibration and withstands a ½ sine shock of up to 30G for 11 ms ±1 ms. These specifications should be considered in relationship to the complete system in which the TCS is installed. The system may attenuate or amplify the shock and vibration experienced by the TCS. In particularly rugged environments, an accelerometer should be used to measure the conditions affecting the system. Shock mounts, vibration isolators and panel stiffeners should be employed as required to improve the vibration characteristics of the total system enclosure. The optional NEMA 12 Panel Mounting Kit (Y1070) includes a gasket that may help to lessen the effects of vibration.

DETAILED SPECIFICATION INFORMATION

Further information on TCS specifications is available on request from Fluke.

Section 5
Designing For Safety

INTRODUCTION

In designing an effective operator interface, considerations such as ease of use, simplicity, and throughput speed are important. A Touch Control Screen (TCS) provides all these benefits and allows the operator to control a complex machine or system efficiently, with a minimum of training. However, it is important to consider factors of safety when designing an operator interface, regardless of what type. This section presents some considerations for designing a safe touch control based operator interface.

The degree to which safety factors should influence the design of the operator interface depends on the application. A TCS used as a machine set-up device (menu to set operating parameters), requires minimal safety mechanisms since most interaction with the TCS occurs off-line. On the other hand, a TCS used as the primary on-line control device for a potentially hazardous machine such as a press, necessitates undertaking significant safety precautions. Always assess the degree of danger to which the operator is exposed by a machine or system. This will dictate the measure of safety that the designer must build into a particular system.

METHODS

In applications where the operator is exposed to considerable danger, such as potential loss of limb or life, personal protection devices such as light curtains, dual-operated palm switches (that ensure both of the operator's hands are out of the way), and machinery guards are strongly recommended. The TCS is appropriate in these applications as a set-up device, but for control functions, hard switches and one or a combination of these protection devices should also be installed.

In those cases where danger to the operator is significant but does not endanger life or limb, it is preferable to activate control functions such as start, stop, reverse, and jog through hard-wired switches. Switches and pushbuttons that require a deliberate effort to activate and are not easily triggered by accident should be used.

In cases where operator exposure to danger is minimal, most TCS safety mechanisms can be implemented through software in the host computer. A double-key method is recommended for activating machine control functions. With the double-key method, the operator must touch two touchkeys sequentially to activate one function. Typically, the operator must SELECT the function through one touchkey, then touch an ENTER key in another location to activate a machine motion.

This helps to reduce inadvertent input errors. It is recommended that the ENTER key be located on a separate screen, or at least be in a separate location from the function touchkey to minimize accidental triggering due to a double touch by the operator.

SERVICE AND MAINTENANCE

It is important to make operator safety provisions not only for when the machine under control is in operation, but also for when it is being serviced. Again, the degree of precaution necessary will depend on the application itself, but some simple and easy-to-implement measures can be made with the TCS.

It is recommended that the host computer send the TOUCH PANEL LOCKOUT command to the TCS whenever the machine is being serviced. When the host issues this command, it completely disables the touch panel from operator activation. When servicing is finished, the host needs only to send another command to re-activate the touch panel. The TOUCH PANEL LOCKOUT command is fully described in Section 6 of the Programmer's Guide.

Applications that pose a high degree of danger should also implement a key lock, where the service technician disables control of the machine and locks out all attempts to turn it back on until servicing has been completed.

INTEGRITY VERIFICATION

To ensure proper operation of the entire machine or system, periodic integrity verification should be done. The TCS provides two easy mechanisms to implement this.

First, the TCS automatically performs a self test every time it is powered up. The self test routine verifies proper operation of all major components in the TCS, including the touch panel. The test automatically disables the touch panel if a switch closure is detected.

Second, if a machine's power is not often cycled, the host computer can initiate the same set of tests through a single command. The TCS performs verifications and reports back to the host. A periodic routine to perform these tests should be implemented in the host program. Remote command tests are fully described in Section 8 of the Programmer's Guide.

OTHER REFERENCES

For more safety design information, refer to OSHA Standards located in the Code of Federal Regulations (Part 1910) and recognized industry standards pertaining to your specific application.

Appendix A
Custom Character Sets

INTRODUCTION

The display character sets supplied with the Touch Control Screen (TCS) can be customized to meet the special needs of the designer. This section describes the character sets and explains how they may be modified.

CHARACTER DESCRIPTION

Character-cell dot patterns are stored in a 2732 erasable programmable read-only memory (EPROM). The character-font EPROM supplied with the TCS contains the standard character set, consisting of 128 characters, and an extended character set consisting of an additional 128 characters. The standard character set is defined by the American Standard Code for Information Interchange (ASCII). The extended character set contains international characters used by National Replacement Codes (NRC), characters for drawing boxes, and other common symbols.

The standard ASCII character set, located in the lower half (addresses 00 through 7F hex) of the character-font EPROM supplied with the TCS, is shown in Table A-1. The extended character set, located in the upper half (addresses 80 through FF hex) of the character-font EPROM, is shown in Table A-2.

Character Set Description

The standard and extended character sets of the TCS contain 256 characters. A complete description of the standard and extended character set, the standard usage of the characters, and the consequences of changing a character in the character-font EPROM are shown in Table A-3.

NOTE

Certain locations in the supplied character sets are reserved for special functions. Due to their special use by the TCS, some of these locations should only be changed with caution. Refer to Table A-3.

Boxtypes

Boxtypes are special characters used to draw boxes or borders on the display. The first 32 positions of the extended character set contain four complete boxtype patterns. These boxtypes are only accessible through use of the Outline a Region Command (see Section 6 of the Programmer's Guide).

Custom borders can be created by changing the data contained in the boxtype locations of the character-font EPROM (positions 80 to 9F hex) as shown in Table

A-4. The boxtype-border EPROM locations are specifically defined by the software in the TCS. When programming new boxtype borders, the box part locations must remain the same in order to draw the box correctly on the display.

Table A-1. Standard Character Set

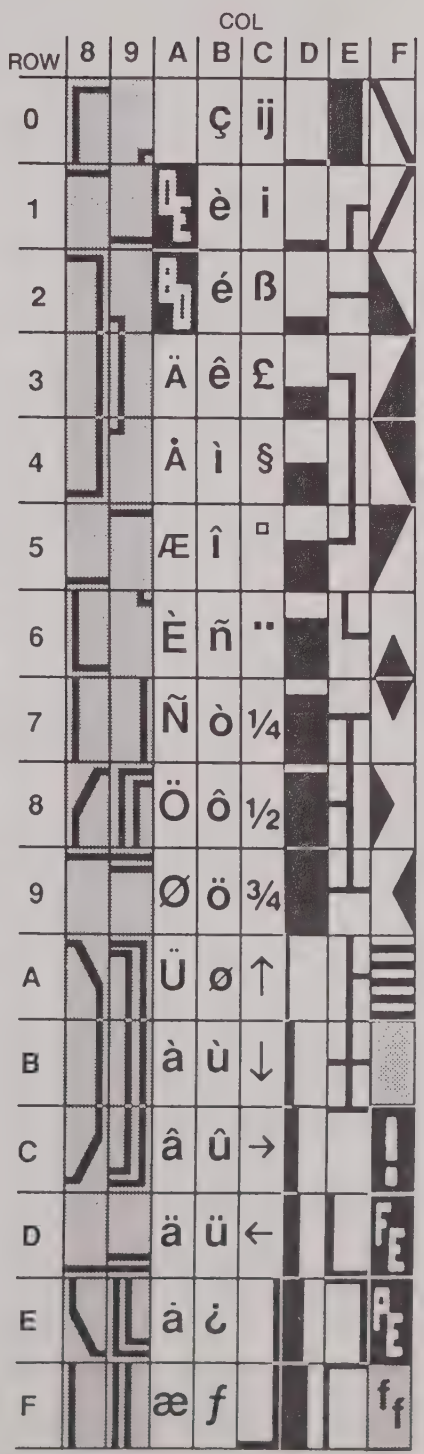
NOTE

In this table, the value of a character in hex can be determined by its row and column position. The column number represents the 16's digit and the row number represents the 1's. For example, character G is specified as column 4, row 7. Therefore, the value of character G is 47 hex.

The shaded characters in this table show the ASCII mnemonics for the respective control codes; these mnemonics are never displayed.

ROW \ COL	0	1	2	3	4	5	6	7
0	NUL	DLE		0	@	P	`	p
1	SOH	DC1	!	1	A	Q	a	q
2	STX	DC2	"	2	B	R	b	r
3	ETX	DC3	#	3	C	S	c	s
4	EOT	DC4	$	4	D	T	d	t
5	ENQ	NAK	%	5	E	U	e	u
6	ACK	SYN	&	6	F	V	f	v
7	BEL	ETB	'	7	G	W	g	w
8	BS	CAN	(	8	H	X	h	x
9	HT	EM	)	9	I	Y	i	y
A	LF	SUB	*	:	J	Z	j	z
B	VT	ESC	+	;	K	[	k	{
C	FF	FS	,	<	L	\	l	|
D	CR	GS	-	=	M	]	m	}
E	SO	RS	.	>	N	^	n	~
F	SI	US	/	?	O	_	o	DT

Table A-2. Extended Character Set



NOTE

In this table, the value of a character in hex can be determined by its row and column position. The column number represents the 16's digit and the row number represents the 1's. For example, character à is specified as column A, row B. Therefore, the value of character à is AB hex.

The shaded characters in columns 8 and 9 contain Boxtype characters that can only be displayed by sending the Outline A Region command. The shaded character at location FF hex is never displayed.

Table A-3. Character Set Description

LOCATION (HEX)	NOTE	STANDARD USAGE	CONSEQUENCES IF CHANGED
00-1F	1	ANSI control codes. Not displayed except on Test Screen.	None.
20	2	Space character.	Erasures and spaces will be replaced by the new character.
21-7E	2	Standard ASCII character set.	Alphanumeric characters and punctuation will be replaced by new characters.
7F	1	Reserved by ANSI. Not displayed except on Test Screen.	None.
80-87	3	Boxtype 1.	Commands referencing Boxtype 1 will use the new characters for the sides and corners of the box.
88-8F	3	Boxtype 2.	Commands referencing Boxtype 2 will use the new characters for the sides and corners of the box.
90-97	3	Boxtype 3.	Commands referencing Boxtype 3 will use the new characters for the sides and corners of the box.
98-9F	3	Boxtype 4.	Commands referencing Boxtype 4 will use the new characters for the sides and corners of the box.
A0	2	Space character. Allows spaces to be easily displayed even while shifted-out to the extended character set.	Space code received while shifted-out will display the new character. Erasure commands are not affected.
A1	2	$^{O}_{E}$ (overrun error).	Overrun errors will display the new character.
A2	2	$^{B}_{O}$ (buffer overflow error).	Buffer overflow errors will display the new character.
A3-C9	2,4	International characters used for NRC support.	NRC will use new characters.
CA-CD	2	Arrow characters.	Setup Screen arrows will be replaced by the new characters.
CE-DO	2	Alignment pattern characters used by the Setup Screen.	Alignment pattern will use new characters.
D0 - D9	2	Vertical bar chart characters.	Vertical bar charts will use new characters.
D9 - E0	2	Horizontal bar chart characters.	Horizontal bar charts will use new characters.

Table A-3. Character Set Description (cont)

LOCATION (HEX)	NOTE	STANDARD USAGE	CONSEQUENCES IF CHANGED
E1 - FB		Miscellaneous graphics characters.	None.
FC	2	Reserved.	May be used in future products for error reporting.
FD	2	$^{F}_{E}$ (framing error).	Framing errors will display the new character.
FE	2	$^{P}_{E}$ (parity error).	Parity errors will display the new character.
FF	1	Reserved by ANSI. Not displayed except in Test Screen.	None.

NOTES:

1. Codes overlying these character positions are reserved by ANSI as non-displayable controls.
2. These positions should not be changed except with caution.
3. See Table A-4 for details.
4. To determine which international characters are used for each NRC, see the description on National Replacement Codes (NRC) in Section 5 of the Programmer's Guide.

Table A-4. Boxtype EPROM Locations

EPROM LOCATION (HEX)	TYPE BORDER	BOX PART	EPROM LOCATION (HEX)	TYPE BORDER	BOX PART
80	BOXTYPE1	Upper left corner	90	BOXTYPE3	Upper left corner
81	BOXTYPE1	Upper side	91	BOXTYPE3	Upper side
82	BOXTYPE1	Upper right corner	92	BOXTYPE3	Upper right corner
83	BOXTYPE1	Right side	93	BOXTYPE3	Right side
84	BOXTYPE1	Lower right corner	94	BOXTYPE3	Lower right corner
85	BOXTYPE1	Lower side	95	BOXTYPE3	Lower side
86	BOXTYPE1	Lower left corner	96	BOXTYPE3	Lower left corner
87	BOXTYPE1	Left side	97	BOXTYPE3	Left side
88	BOXTYPE2	Upper left corner	98	BOXTYPE4	Upper left corner
89	BOXTYPE2	Upper side	99	BOXTYPE4	Upper side
8A	BOXTYPE2	Upper right corner	9A	BOXTYPE4	Upper right corner
8B	BOXTYPE2	Right side	9B	BOXTYPE4	Right side
8C	BOXTYPE2	Lower right corner	9C	BOXTYPE4	Lower right corner
8D	BOXTYPE2	Lower side	9D	BOXTYPE4	Lower side
8E	BOXTYPE2	Lower left corner	9E	BOXTYPE4	Lower left corner
8F	BOXTYPE2	Left side	9F	BOXTYPE4	Left side

HOW CHARACTERS ARE STORED

Characters displayed on the TCS consist of character cells. A character cell is a portion of the display 8 dots wide by 10 dots high. These dots are turned on or off by the data contained in the character-font EPROM. Since every dot in each character cell can be displayed, graphic characters can be easily created.

Sixteen consecutive bytes are reserved in the character-font EPROM for each character. The first byte corresponds to the top row of dots in a character cell. The tenth byte corresponds to the bottom row. The last six bytes are not used on the display.

The hexadecimal EPROM address of each byte is its ASCII code in hexadecimal followed by its byte number within the character cell. The byte number for each character cell starts at zero (the top row of dots). For example, the EPROM address of the third row of dots (or byte) for the capital letter H (ASCII 48 hex) is 482. Figure A-1 demonstrates how the capital letter H is encoded.

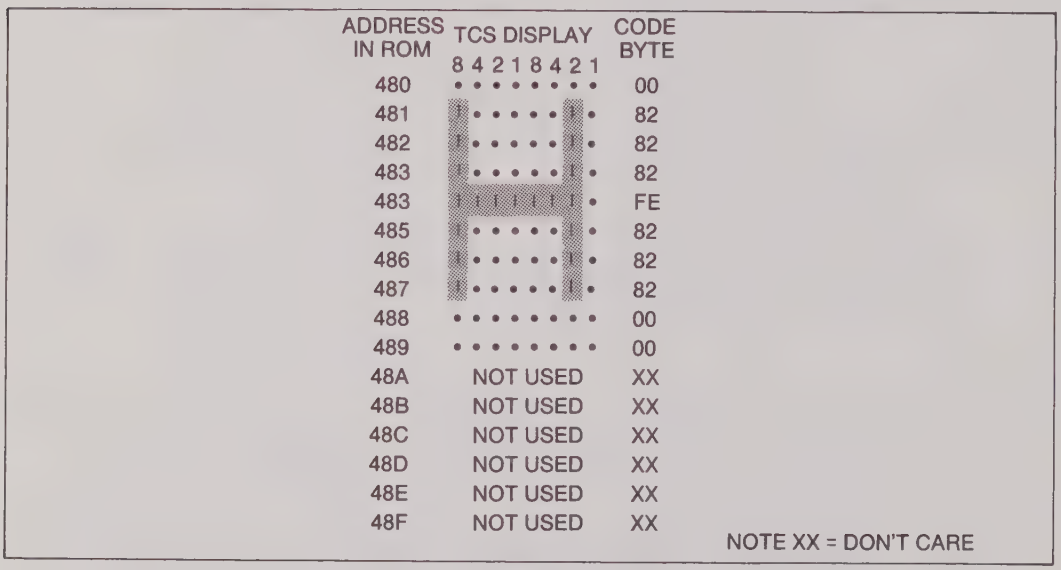


Figure A-1. Encoding the Letter H

Each 1-bit in the character cell corresponds to a displayed dot. Each 0-bit in the character cell is not displayed. The least significant bit of each character cell byte is in the rightmost position. (In Figure A-1, each dot represents a "0" in the character cell.)

Character display addressing is illustrated in Figure A-2, using the capital letter H as an example. (Again, each dot in the figure represents a "0" in the character cell.)

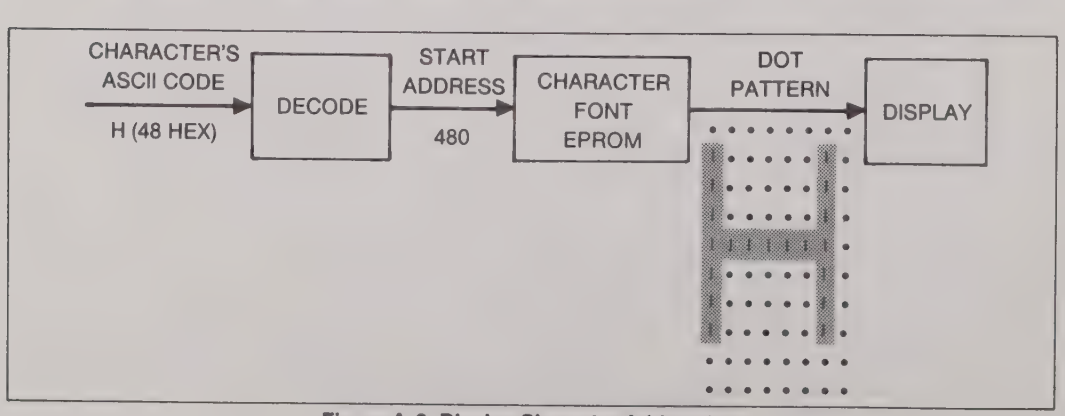


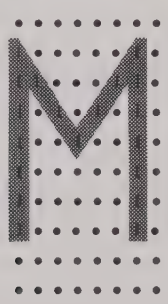
Figure A-2. Display Character Addressing

The ASCII code 48 (hex) corresponds to the letter H. This number is decoded by the TCS firmware, which retrieves the dot pattern from the character-font EPROM. The dot pattern is then shown on the TCS display as a set of dots that form the letter H.

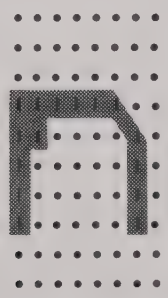
Character Sizes

The standard ASCII display characters are designed according to the following rules:

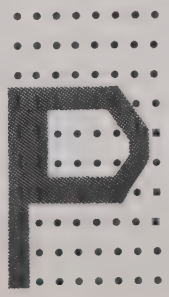
- Uppercase characters, numerals, and symbols like the percent and dollar signs, and brackets and braces are designed within a region 7 pixels high by 7 pixels wide. The bottom of the character is placed 2 pixels above the bottom of the character cell. The leftmost side of the character region is justified to the left column of pixels in the character cell.



- Lowercase letters are designed within a region 5 pixels high by 7 pixels wide. The bottom of the character is placed 2 pixels above the bottom of the character cell. The leftmost side of the character region is justified to the left column of pixels in the character cell.



- Lowercase letters with descenders have the body of the character 4 pixels high by 7 pixels wide with a 3-pixel high descender. Letters with descenders extend to the bottom of the character cell. The leftmost side of the character region is justified to the left column of pixels in the character cell.



- Lowercase letters with ascenders are designed within a region 7 pixels high by 7 pixels wide. The bottom of characters with ascenders is placed 2 pixels above the bottom of the character cell. The leftmost side of the character region is justified to the left column of pixels in the character cell.

CHARACTER-FONT EPROM PROGRAMMING METHODS

NOTE

Use a 2732 EPROM with a maximum access time of 250 ns.

There are two methods for programming a custom character-font EPROM. One method uses a character pattern chart (supplied at the back of this appendix) to design each character. Sufficient copies of the pattern chart may be made to design a complete set of custom characters. When a custom character set is completed, the charts may be sent to Fluke to be programmed into an EPROM. For more information on this method, contact your local Fluke Sales or Service Center.

The second method requires an EPROM programmer capable of programming a 2732 EPROM. The addresses of the EPROM may be programmed with the custom character desired, following the example described in Figure A-1. To simplify the design of the characters, use the character pattern chart to lay out the character patterns for the entire EPROM. This saves time and helps prevent mistakes. After all the character patterns are complete, program the EPROM.

NOTE

Refer to Table A-3 for a description of character locations that may cause problems if changed.

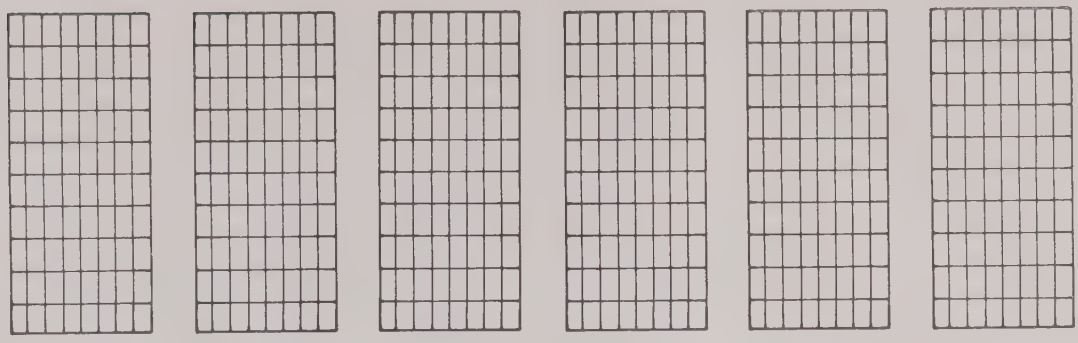
In most cases, the first 128 locations in the new EPROM should be programmed with the standard ASCII character set supplied with the unit. If an EPROM programmer is used, remove the EPROM supplied with the unit and load the first 128 locations into the programmer's memory. Then program the new character set into the last 128 locations of the programmer's memory. Be sure to set aside the original EPROM so if an error is made, the original EPROM can still be used in the TCS. Also, the original EPROM must be in place if the logic board needs repair. To simplify EPROM programming, a programmed character-font EPROM should be read into the EPROM programmer, and only the desired locations should be changed.

EPROM INSTALLATION PROCEDURE

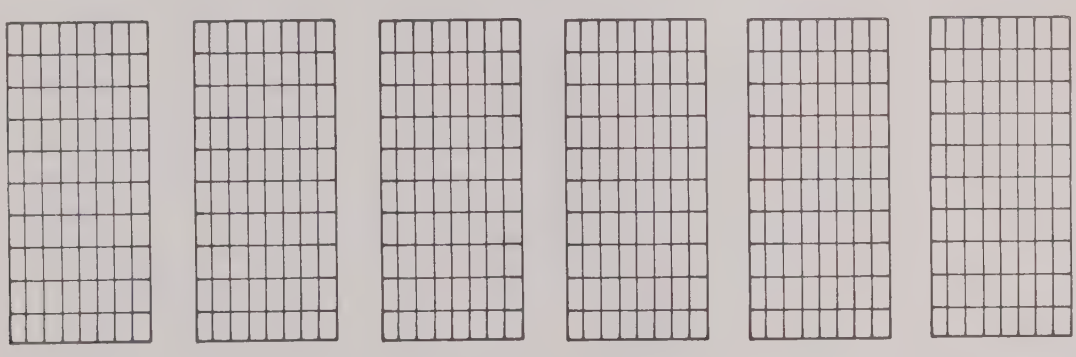
CAUTION

To avoid damaging static-sensitive MOS components such as the character-font EPROM, observe the precautions outlined on the Static Awareness sheet when removing or replacing the EPROM.

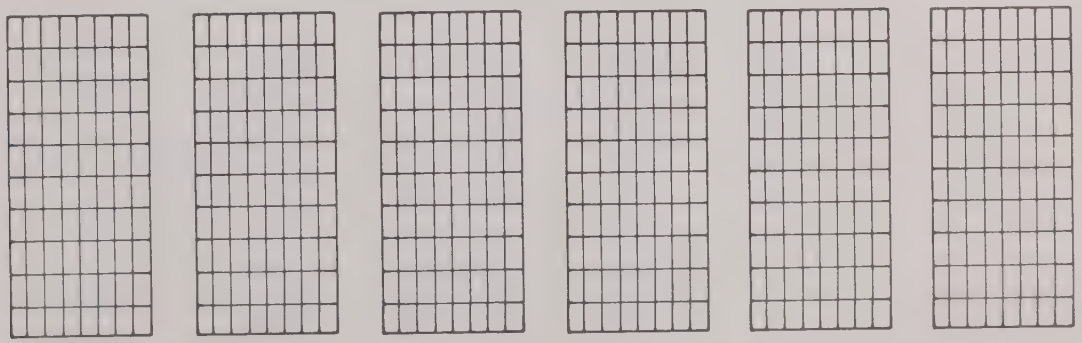
Custom Character Pattern Chart



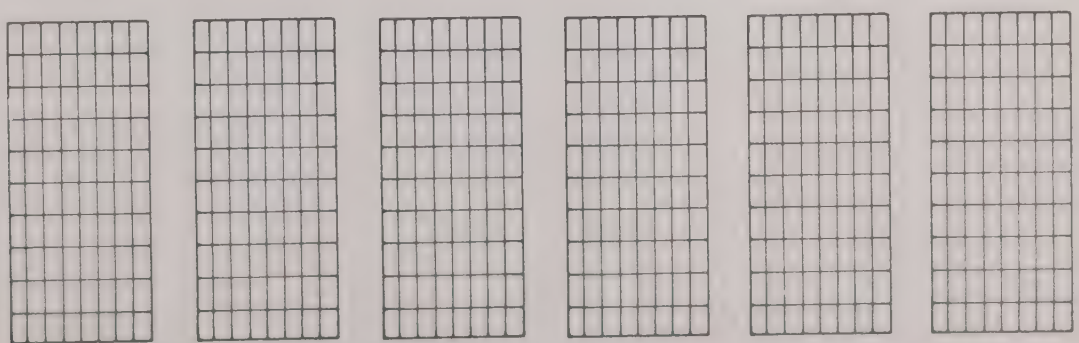
ASCII Code _____ _____ _____ _____ _____ _____



ASCII Code _____ _____ _____ _____ _____ _____

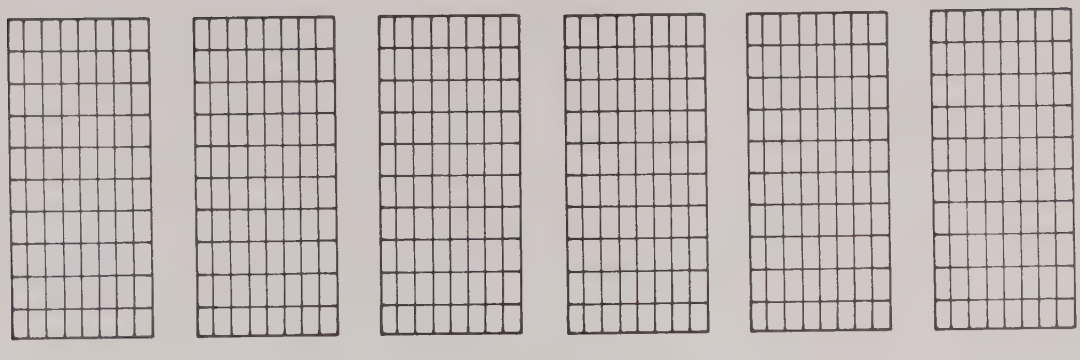


ASCII Code _____ _____ _____ _____ _____ _____

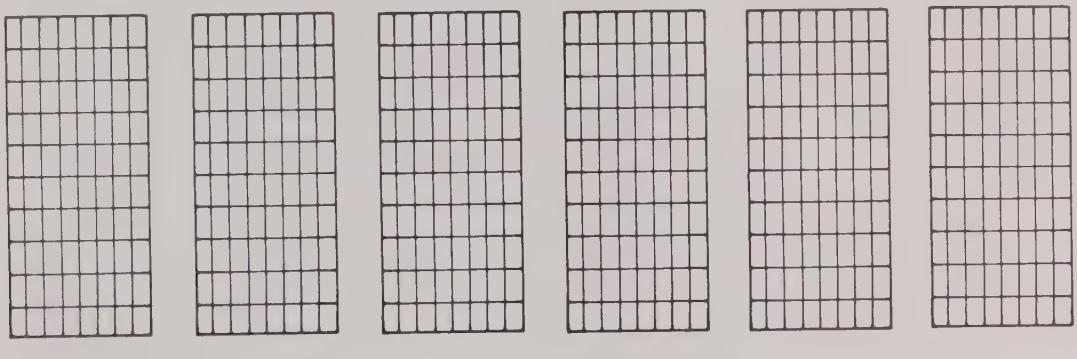


ASCII Code _____ _____ _____ _____ _____ _____

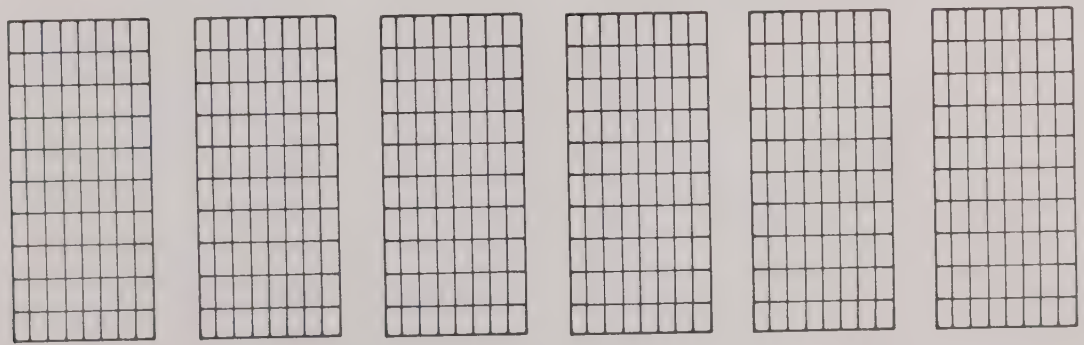
Custom Character Pattern Chart



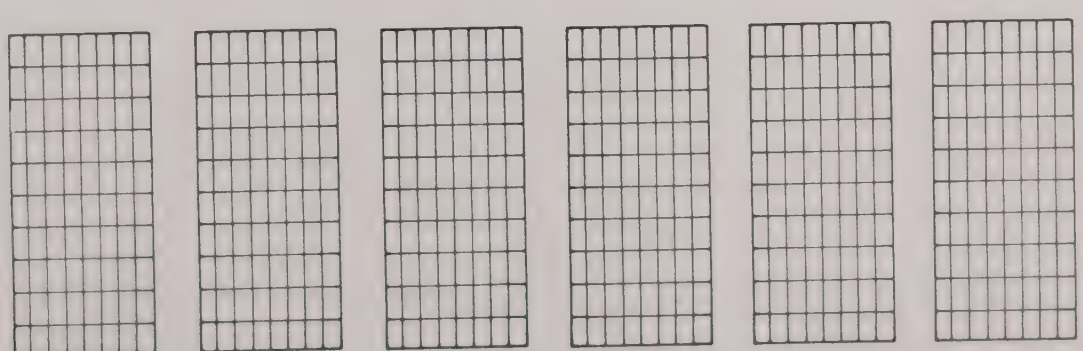
ASCII Code _____ _____ _____ _____ _____ _____



ASCII Code _____ _____ _____ _____ _____ _____

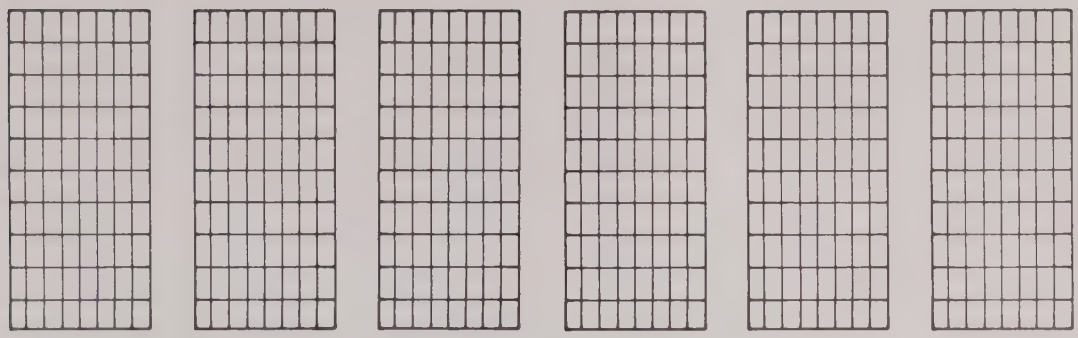


ASCII Code _____ _____ _____ _____ _____ _____

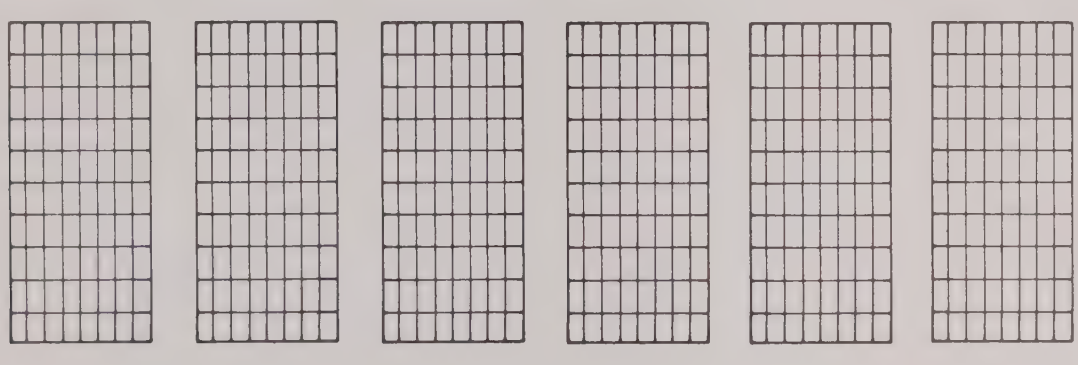


ASCII Code _____ _____ _____ _____ _____ _____

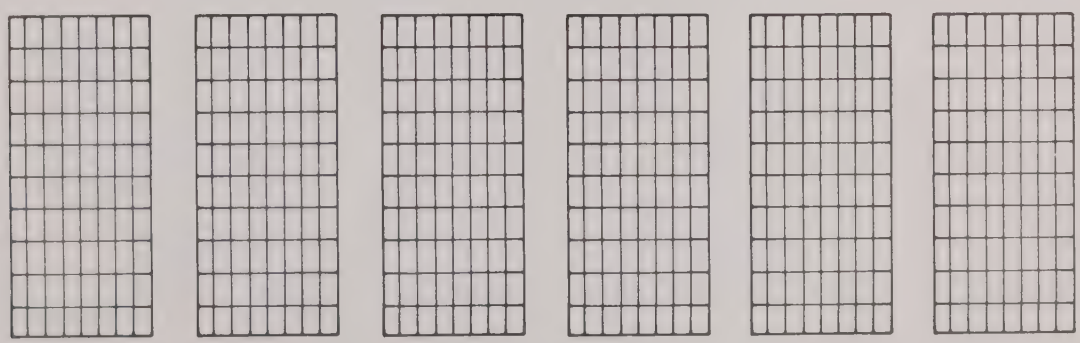
Custom Character Pattern Chart



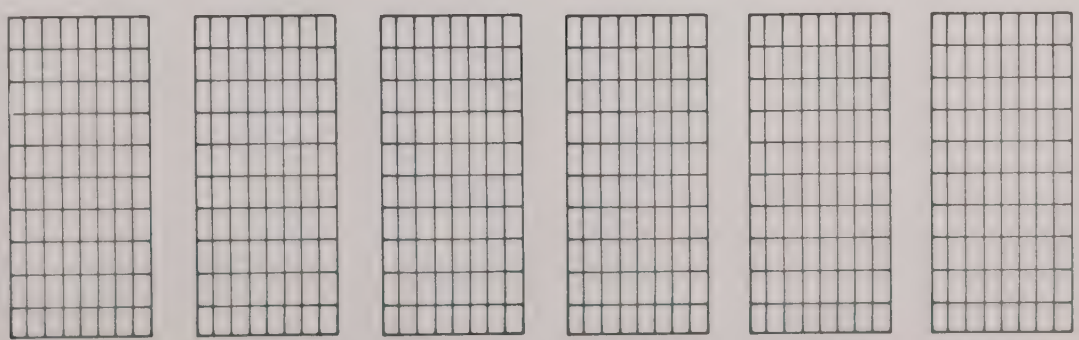
ASCII Code _____ _____ _____ _____ _____ _____



ASCII Code _____ _____ _____ _____ _____ _____

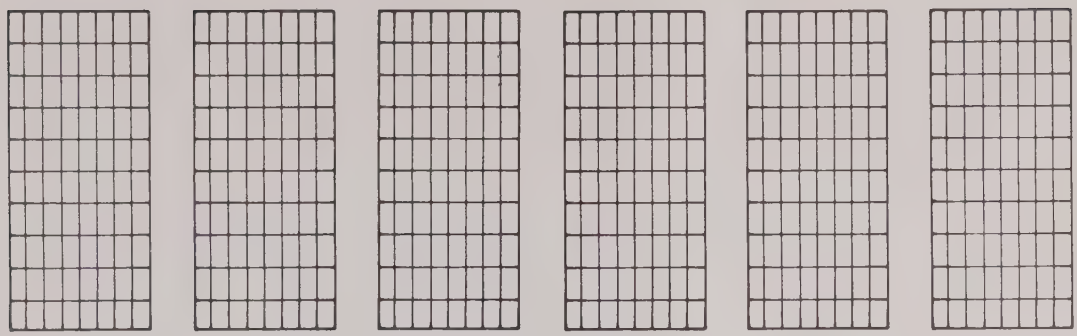


ASCII Code _____ _____ _____ _____ _____ _____

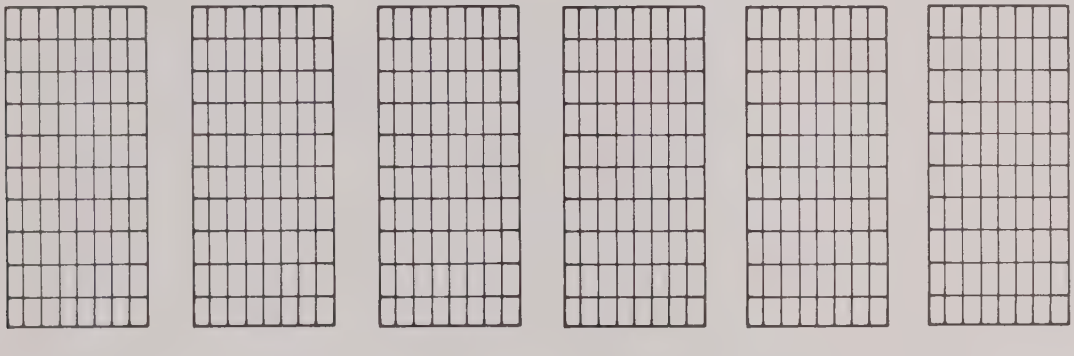


ASCII Code _____ _____ _____ _____ _____ _____

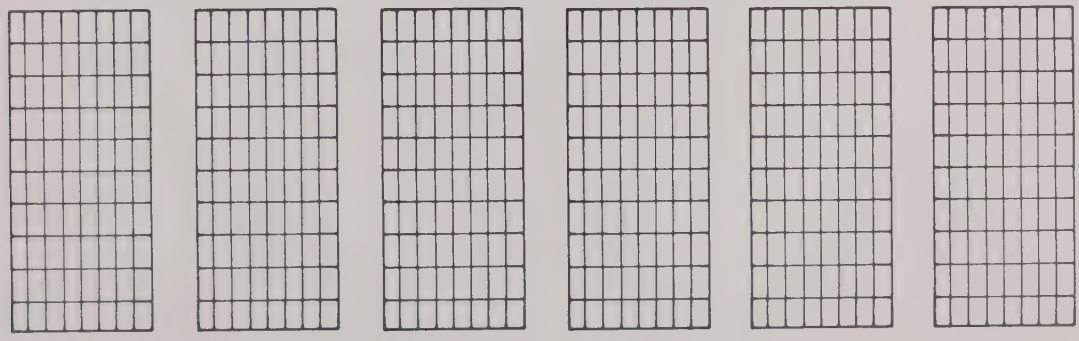
Custom Character Pattern Chart



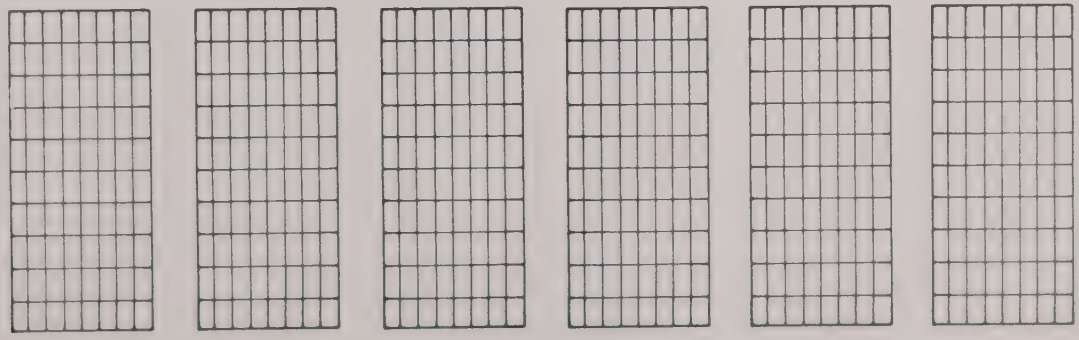
ASCII Code _____ _____ _____ _____ _____ _____



ASCII Code _____ _____ _____ _____ _____ _____

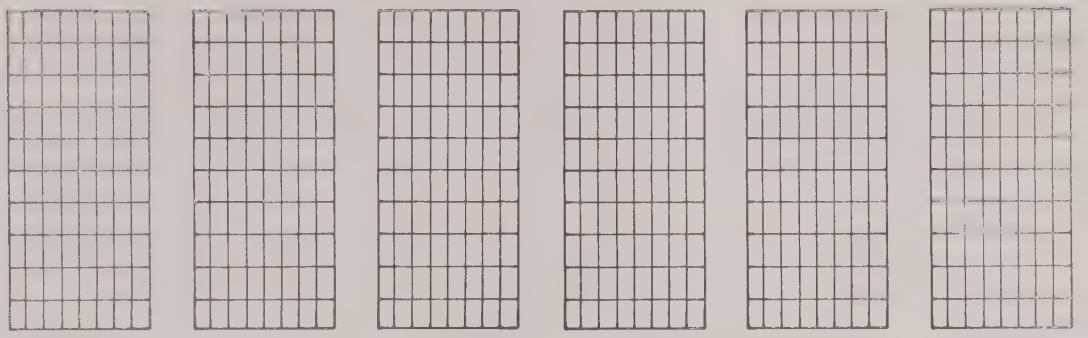


ASCII Code _____ _____ _____ _____ _____ _____

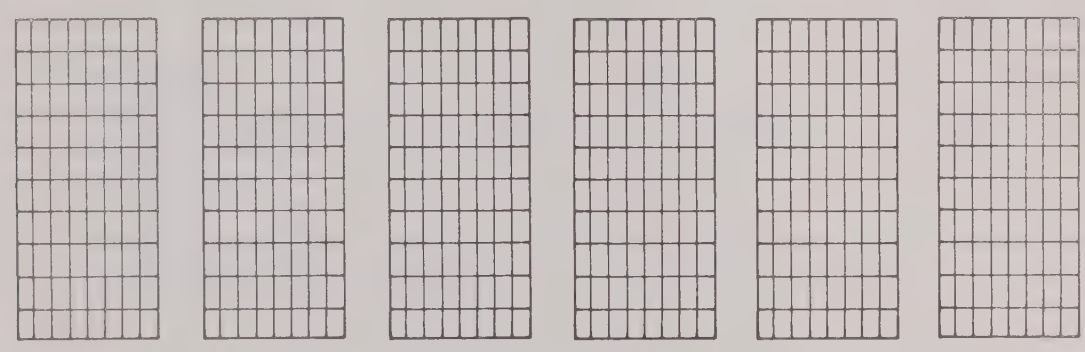


ASCII Code _____ _____ _____ _____ _____ _____

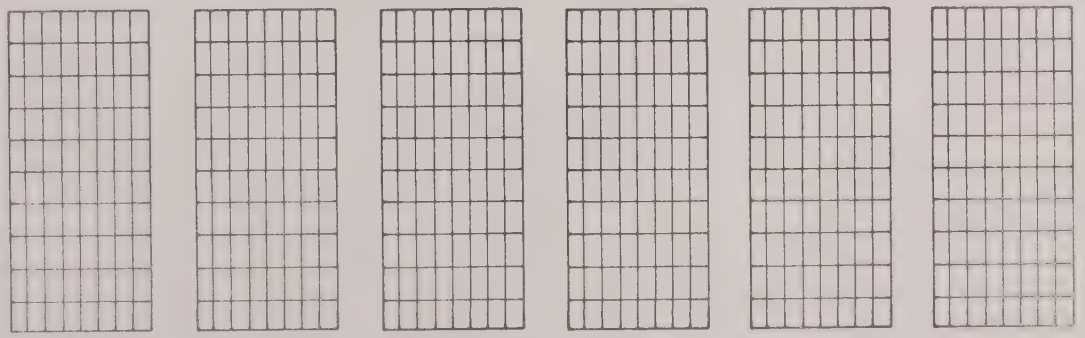
Custom Character Pattern Chart



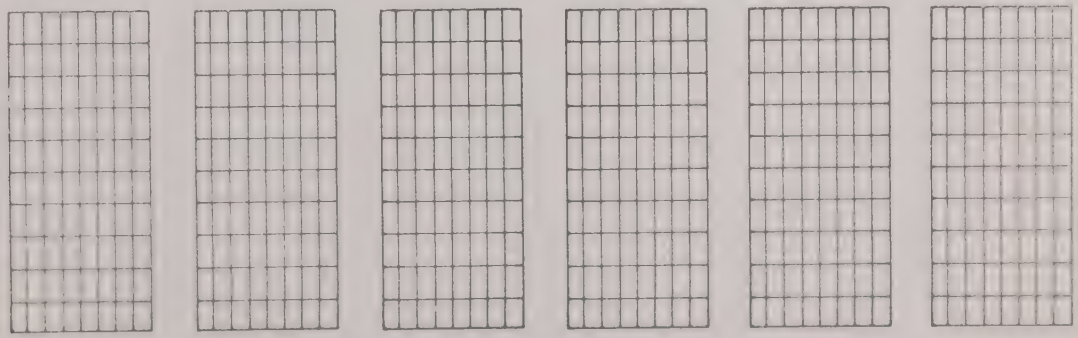
ASCII Code _____ _____ _____ _____ _____ _____



ASCII Code _____ _____ _____ _____ _____ _____



ASCII Code _____ _____ _____ _____ _____ _____



ASCII Code _____ _____ _____ _____ _____ _____

Appendix B
Raw Keyboard Codes and Keyboard Interface

INTRODUCTION

This appendix lists the raw keyboard codes generated by the optional keyboard. These codes are used only between the keyboard and the TCS, and are independent of ASCII codes sent to the host.

Each key sends a specific code to the TCS logic board, which in turn interprets the code. One code is sent to indicate a key has been pressed, another code is sent to indicate the key has been released.

The complete set of raw keyboard codes is contained in Tables B-1 and B-2. The tables do not contain the shifted characters, since the Shift key sends its own set of codes. These codes are displayed during the raw keyboard test in the test screen.

NOTE

*The electrical interface to the keyboard is IBM®*PC compatible. Some, but not all, of the keyboard codes are compatible with the keyboard codes for the IBM PC computer. Interchanging the TCS keyboard with an IBM PC keyboard can lead to unpredictable results.*

**IBM is a registered trademark of International Business Machines, Corporation*

Table B-1. Raw Keyboard Codes

KEY	CODE SENT WHEN PRESSED (HEX)	CODE SENT WHEN RELEASED (HEX)
0	0B	8B
1	02	82
2	03	83
3	04	84
4	05	85
5	06	86
6	07	87
7	08	88
8	09	89
9	0A	8A
a	1E	9E
b	30	B0
c	2E	AE
d	20	A0
e	12	92
f	21	A1
g	22	A2
h	23	A3
i	17	97
j	24	A4
k	25	A5
l	26	A6
m	32	B2
n	31	B1
o	18	98
p	19	99
q	10	90
r	13	93
s	1F	9F
t	14	94
u	16	96
v	2F	AF
w	11	91
x	2D	AD
y	15	95
z	2C	AC
–	0C	8C
=	0D	8D
'	29	A9
[	1A	9A
]	1B	9B
;	27	A7
'	28	A8
\	2B	AB
,	33	B3
.	34	B4
/	35	B5
Esc	01	81
Back Space	0E	8E
Break	76	F6

Table B-1. Raw Keyboard Codes (cont)

KEY	CODE SENT WHEN PRESSED (HEX)	CODE SENT WHEN RELEASED (HEX)
Tab	0F	8F
⌫	53	D3
Ctrl	1D	9D
Caps Lock	3A	BA
Return	1C	9C
Scroll Lock	46	C6
Shift (l.)	2A	AA
Shift (r.)	36	B6
Line Feed	77	F7
↑	48	C8
↓	50	D0
←	4B	CB
→	4D	CD
Space	39	B9
F1	3B	BB
F2	3C	BC
F3	3D	BD
F4	74	F4
F5	3E	BE
F6	3F	BF
F7	40	C0
F8	41	C1
F9	75	F5
F10	42	C2
(blank)	43	C3
Set Up	44	C4

Table B-2. Raw Keypad Codes

KEY	CODE SENT WHEN PRESSED (HEX)	CODE SENT WHEN RELEASED (HEX)
PF1	60	E0
PF2	61	E1
PF3	62	E2
PF4	63	E3
0	70	F0
1	6C	EC
2	6D	ED
3	6E	EE
4	68	E8
5	69	E9
6	6A	EA
7	64	E4
8	65	E5
9	66	E6
-	67	E7
,	6B	EB
.	72	F2
Enter	73	F3

Appendix C
Glossary

address

A coded number representing the location of an item. Examples include bus address and program address.

Alignment Screen

Display screen used to realign the horizontal and vertical position of the display on the face of the CRT to match the overlying touch panel. The Alignment Screen is accessed from the Setup Screen.

ANSI

American National Standards Institute, Inc., a group that develops and publishes industry standards.

application software

A program running on a host computer designed to perform specified functions in a working environment.

ASCII

American Standard Code for Information Interchange as defined by ANSI document X3.4-1977. ASCII is a standardized code set for 128 characters, including full alphabetic (upper and lower case), numerics, punctuation, and a set of control characters.

asynchronous data

Information transmitted or received at random times with respect to a particular system. In terminals, asynchronous data usually consists of one character at a time, and at predefined, self-clocking baud rates. See also synchronous data.

baud rate

The serial transfer rate in bits per second including all framing bits used to identify the start and end of characters or messages.

binary

A number system based on zero (0) and one (1) representations, often used to represent data or instruction codes. In binary there are only two numbers, so digital computers can use binary for their operation because each number can be represented as the state (on or off) of a transistor.

bit

A contraction of binary digit. A bit is either a 1 or a 0 and represents the smallest single unit of computer information. Bits are often used in groups of seven or eight to represent characters.

boxtypes

Graphics characters used by the TCS to draw rectangular boxes on the screen. Boxtypes are used to create touchkeys.

break

A communication signal that can be recognized at any baud rate. The TCS generates a short break when the Break key on the optional keyboard is pressed, and a long break when Shift/Break is pressed. The TCS ignores any break it receives. See also short break and long break.

buffer

A storage location for information.

byte

A grouping of bits that represent a single character.

character cell

A portion of the display 8 pixels wide by 10 pixels high that is used to display a character. The TCS has 1920 character cells arranged in 24 lines of 80 characters.

character set

The character set includes the upper-case and lower-case alphabet, the ten numerals, punctuation, graphic characters, boxtypes, international characters, and control characters.

character string

A grouping of characters.

control character

A nonprintable character used to produce a specific action such as a carriage return or line feed, or halting and restarting scrolling.

control sequence

An ANSI X3.64-1979 or ANSI-compatible sequence of ASCII characters that produces a desired display effect such as cursor position or reverse video.

Control Sequence Introducer

Special characters that cause the characters following it to be interpreted as an ANSI-standard or ANSI-compatible control sequence.

CPU

Central processing unit, the controlling instruction and data processor in any computer system. In the TCS, the CPU is a 68008 microprocessor with its supporting components located on the logic board.

CRT

Cathode-ray tube, the display screen on the front of the TCS.

CTS

Clear to Send, a signal used in RS-232-C communication. The TCS will not transmit data if CTS is off (low).

cursor

The visible pointer on the CRT display that indicates to the user the position where the next character will appear.

data

Normally refers to information that has been collected for interpretation by a program.

DCE

Data communication equipment as described by the EIA Standard RS-232-C. Modems and null-modem cables are examples of DCE. As specified by RS-232-C, in order to make a communications link, DCE must be connected to data terminal equipment (DTE).

default value

The parameter value that is assumed when no explicit value, or sometimes a value of 0, is specified.

display

The area on the CRT that can display character cells.

DSR

Data Set Ready, a signal used in RS-232-C communication. The TCS does not transmit characters to the host unless the DSR signal is on (high).

DTE

Data terminal equipment as described by the EIA Standard RS-232-C. The TCS is an example of DTE. As specified by RS-232-C, in order to make a communications link, DTE must be connected to data communication equipment (DCE).

DTR

Data Terminal Ready, a signal used in RS-232-C communication. The TCS sets the DTR signal on (high) when it is ready to begin communication with the host. DTR is subsequently set off (low) only during a long break or reset.

EIA

Electronic Industries Association, publisher of standards RS-232-C and RS-422-A for binary serial data communication.

EPROM

Erasable Programmable Read Only Memory. A memory device that can be erased with ultraviolet light and reprogrammed using specialized equipment.

escape sequence

A string of ASCII characters beginning with the escape character ⟨ESC⟩. These strings generally convey special programming and control information between the host and the TCS when sent over the serial port. (This is also called a control sequence).

Extended Characters

Characters in the upper half (128 positions) of the 256-character set.

firmware

Computer programs and data that are recorded in permanent memory. See ROM.

handshaking

A method by which data is exchanged between devices only when each device has signaled that it is ready.

hard reset

A reset command executable only by the host computer that returns all the parameters of the TCS to their factory-programmed default values. The TCS then undergoes a normal power-up sequence.

hexadecimal

A number system based on 16 digits. Sometimes called hex, the system uses 0 through 9, and A, B, C, D, E, and F, to represent the digits above 9.

host

A separate product or system (usually a computer) that interacts with the TCS through the RS-232-C serial interface.

input buffer

The buffer within the TCS containing characters received from the host.

interface

A hardware and software connection of devices within a system.

LED

Light-emitting diode. Used as indicators on the Scroll Lock and Caps Lock keys on the optional keyboard. The LEDs are lit when the keys are locked and off when the keys are unlocked.

long break

A communication disruption sent by the TCS when the optional keyboard keys Shift/Break are pressed. A long break sets the DTR and RTS signals low for 3.5 seconds.

NEMA

National Electrical Manufactures Association. Publishers of various standards, including the NEMA 12 standard that describes dust-proof and water-resistant enclosures.

non-volatile memory

An electronic memory that retains its contents when power is turned off. The TCS uses non-volatile memory to store programmable characteristics of the TCS between operating sessions.

NRC

National Replacement Code. One of several standardized codes whereby some standard ASCII codes are displayed as characters particular to a given nationality's language.

mnemonic

From the technique used to help a person memorize information, an abbreviated name for something. Examples of mnemonics are "XON" and "XOFF", for "transmit-on" and "transmit-off".

output buffer

The buffer within the TCS containing characters to be sent to the host.

parallax

An optical effect that occurs when viewing two objects at different distances from different angles. For example, the distance from the surface of the touch panel to the image on the tube, when viewed from an angle, can cause the user to misread the location of a visual target relative to the touch panel. This is parallax error.

parameter

An adjustable operating feature. Examples of parameters of the TCS include baud rate, cursor type, and light or dark background.

parameter string

A set of values within a control string that defines exactly how the control string should be interpreted by the TCS.

parity

A method of error detection that uses one extra bit for each unit of information (such as a byte). The parity bit is set to 1 or 0 so that the total number of 1s in the byte, together with the parity bit, is even or odd.

pixel

Acronym for picture element; the smallest amount of visual information that the display is able to resolve; one dot.

port

A connection point used for data transfer. See interface.

power-up sequence

The sequence of events after power is applied until the TCS is ready to assume full functional operation under the command of the user and/or host.

program

Any meaningful sequence of computer instructions that causes a system to accomplish a task.

PROM

Programmable Read Only Memory, a memory device that can be programmed using specialized equipment.

protocol

A set of rules for exchange of information between systems or devices.

RAM

Random-access memory. Through common usage, the term has come to mean the high-speed volatile semiconductor memory that is normally used for system and user memory. It is memory, both readable and writeable, used to store and recall information.

raster

The scanning pattern of an electron beam on a CRT display. A raster display uses the same scan pattern all the time, forming images by turning the beam on and off at appropriate times.

RLSD

Received Line Signal Detect, a signal used in RS-232-C communication. The TCS ignores data when RLSD is off (low).

ROM

Read-only memory. A memory used for permanently recorded computer programs and data.

RS-232-C

A digital communication standard agreed upon by participating manufacturers of data communication equipment for the transfer of serial digital data between data communication equipment (DCE) and data terminal equipment (DTE). The TCS is a DTE device. The standard is published and maintained by the Electronic Industries Association (EIA).

RS-422-A

An Electronic Industries Association (EIA) data communication standard that specifies two balanced-voltage signal lines that are independent of signal ground for each data channel. With RS-422-A, two pairs of balanced lines carry the data as a differential signal. This offers longer distance and higher signaling rates for direct-connect use than RS-232-C.

RTS

Request to Send, a signal used in RS-232-C communication. The TCS sets RTS on (high) whenever it can support communication with the host.

serial data

Information transmitted one bit at a time at a predefined baud rate.

serial port

A physical connector for transmitting and receiving serial data. The TCS uses the industry standard D-type connector for an RS-232-C interface.

Setup Screen

Display screen used to change various TCS parameters, and used to call up the Test and Alignment Screens. The Setup Screen may be entered by pressing the Set Up key on the optional keyboard or the SET UP switch on the rear panel (if accessible).

short break

A communication disruption sent by the TCS when the Break key on the optional keyboard is pressed. A short break sets the Transmit Data (TD) signal low for 300 milliseconds. The host recognizes a short break regardless of its baud rate setting.

soft reset

A reset command executable by the user through the Setup Screen or the host via a remote command that returns all the parameter values of the TCS to the last saved configuration. The TCS then undergoes a normal power-up sequence.

software

Computer programs and data recorded and used on a medium that can be erased and rewritten by program command.

SRTS

Secondary Request to Send, a signal used in RS-232-C communication. The TCS sets this signal off (low) when it sends the XOFF character to the host, and it sets SRTS on (high; the normal state) when it sends the XON character.

Standard Characters

Characters in the lower half (128 positions) of the 256-character set.

synchronous data

Digital information transmitted in predetermined message block sizes with a clock signal to synchronize the receiver to the transmitter. See also asynchronous data.

system

An interconnection of instruments or other devices.

target

A visual image displayed on the screen, perceived by the user as a single box, icon, group of characters, or other graphic symbol. A target indicates a location for the user to touch the screen.

TCS

The Touch Control Screen; this product, consisting primarily of a display screen and touch panel.

Test Screen

Display screen used to perform user-initiated tests of the TCS. The Test Screen is accessed from the Setup Screen.

touch cell

An individual physical switch on the touch panel. The touch panel on the TCS has 120 touch cells arranged in 12 rows by 10 columns.

touchkey

A group of one or more touch cells in conjunction with a visual target that work together as a command entry point for the user. All touch cells in the group are defined by the programmer as a touchkey, so the program recognizes an input from any of the touch cells as the same entry.

touch panel

The transparent overlay residing in front of the display, that detects physical touch against areas of the display.

UART

Universal Asynchronous Receiver-Transmitter. An integrated circuit that performs serial transmission and reception of information over a communication link.

XOFF

"Transmit-off" character sent to signal that transmission of data should be stopped from a source to a destination. This character is an ASCII ⟨DC3⟩ (decimal 19, hex 13). The XOFF character is sent to the host when the user types Ctrl/S on the optional keyboard or when the input buffer is full.

XON

"Transmit-on" character sent to signal that transmission of data is allowed from a source to a destination. This character is an ASCII ⟨DC1⟩ (decimal 17, hex 11). The XON character is sent to the host when the user types Ctrl/Q on the optional keyboard or when the input buffer again has room.

Index

AC Line Lock, 3-18
About the Designer's Guide, 1-2
Accessories, 1-4
Accessory Cable, RS-232-C, 3-7
Alternate Keyboard Signals, 3-15

Balanced Transmit and Receive Data, 3-5
Baud Rate, 3-8
Beeper Specifications, 2-3
Beeper, 3-12
Boxtype Locations, A-5
Boxtypes, A-1

CRT Specifications, 2-2
Character Cells, A-5
Character Description, A-1
Character Pattern Chart, A-8
Character Set Description, A-1
Character Sizes, A-7
Character-Font EPROM Programming Methods, A-8
Clear to Send, 3-3
Composite Video, 3-15
Contamination, Resistance to, 4-8
Ctrl/Q, 3-9
Ctrl/S, 3-9
Custom Connector, 3-11
  How to Use, 3-13
  Pin Definitions, 3-11
  Shielding, 3-13

Data Communication Equipment, 3-2
Data Set Ready, 3-4
Data Terminal Equipment, 3-2
Data Terminal Ready, 3-4
Detailed Specification Information, 4-8
Differential Signal, 3-5
Display Character Addressing, A-6
Display Characteristics, 2-3
Display Scroll Control, 3-10

EPROM Installation Procedure, A-8
EPROM Programmer, A-8
EPROM Programming Methods, Character-Font, A-8
Environmental Considerations, 4-7
Environmental Specifications, 2-1
Extended Character Set, A-3
External Contrast Connection, 3-17
External Keyboard Connection, 3-16
External Setup Switch Connection, 3-13

Features, 1-1

Host Communication Considerations, 3-8
Host Interface Buffering Limitations, 3-8
Host Interface XON/XOFF Control, 3-9

Input Buffer, 3-8
Installation Procedure, EPROM, A-8

Jumper Locations, 3-13
Jumper Modifications, 3-14

Keyboard Codes, Raw, B-2
Keyboard Interface, B-1
Keyboard Lockout Mode, 3-11
Keyboard, 2-3
Keypad Codes, Raw, B-3

Mounting Dimensions, 4-2

Null-Modem Cable, 3-6

Options, 1-4
Ordering Information, 1-4
Output Buffer Full, 3-11
Output Buffer, 3-8

Packaging Specifications, 2-2
Panel Mounting Considerations, 4-2

Panel Mounting Dimensions, 4-3
Panel Mounting the TCS, 4-4
Pin Definitions, Custom Connector, 3-12
Power Line Connections, 3-1
Protective Ground, 3-2

Raw Keyboard Codes, B-2
Raw Keypad Codes, B-3
RS-232-C Cable Configuration,
  Accessory Cable, 3-7
  Minimum Configuration, 3-5
  Null-Modem Cable, 3-6
RS-232-C Connector, 3-1
RS-232-C Interface Pin Assignment, 3-2
RS-232-C Signal Descriptions, 3-2
RS-422-A, 3-5
  Cable Configuration, 3-7
  Differential Signal, 3-5
  Resistive Termination, 3-7
Rack Mounting the TCS, 4-4
Received Data, 3-3
Received Line Signal Detector, 3-4
Recommended Cabling, 3-5
Request to Send, 3-3
Reset, 3-16
Resistance to Contamination, 4-8

Safety, 5-1
Scroll Lock Key, 3-9
Secondary Request to Send, 3-4
Sending XOFF to the Host, 3-9
Sending XOFF to the TCS, 3-9
Sending XON to the Host, 3-9
Sending XON to the TCS, 3-10
Setup Lockout Mode, 3-11
Shock and Vibration, 4-8
Signal Ground, 3-2
Specification Information, Detailed, 4-8
Specifications, 2-1
Standard Character Set, A-2
Standards, 2-3
  ANSI/UL 478, 2-3
  CSA 556B, 2-3
  FCC Part 15, 2-3
  IEC 348, 2-3
  IEC 435, 2-3
  VDE 0871, 2-3
Surface Mounting, 4-4

Temperature, 4-7
Touch Panel Lockout Mode, 3-10
Touch Panel Specifications, 2-2
Transmitted Data, 3-2

User Input Disable, 3-10
User Interface Control, 3-10

Vibration, Shock and, 4-8
Voltages, 3-12

XON/XOFF Control, 3-8